DECEMBER 12, 1955

Electrical World

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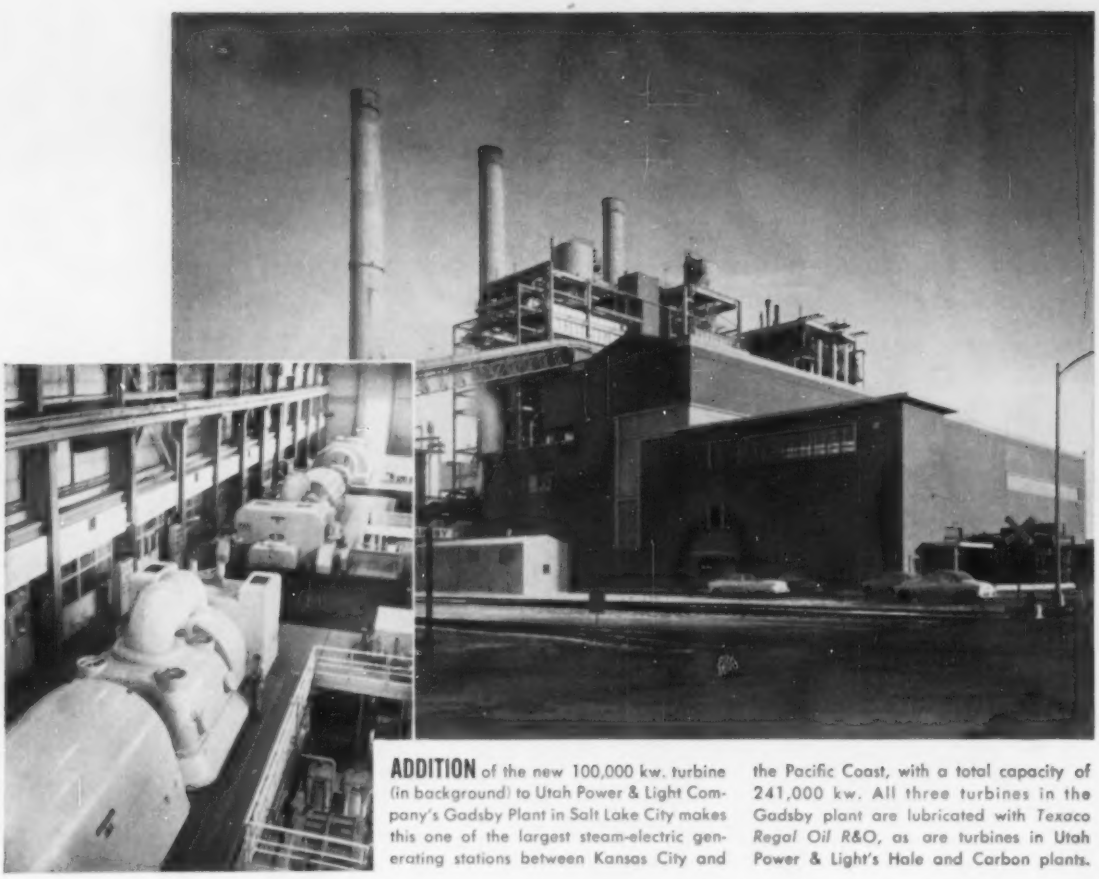
Underground Distribution Is Adaptable for Residential Developments ... Page 107

Hot Transmission Splices Are Easily Detected . . . . . Page 98

ELECTRICAL WEEK . . . . . Page 86



ADDITION of the new 100,000 kw. turbine (in background) to Utah Power & Light Company's Gadsby Plant in Salt Lake City makes this one of the largest steam-electric generating stations between Kansas City and the Pacific Coast, with a total capacity of 241,000 kw. All three turbines in the Gadsby plant are lubricated with *Texaco Regal Oil R&O*, as are turbines in Utah Power & Light's Hale and Carbon plants.

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Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

VOL. 144 No. 24 December 12, 1955

INDUSTRIAL-Design
LIGHTING PRETESTED IN MOCKUP.....Felix Graham 94

TRANSMISSION-Maintenance
BAD SPLICES ARE EASILY DETECTED.....R. M. Havourd 98

GENERATION-Operation-Maintenance
AUTOMATION CUTS COOLING TOWER COSTS.....E. W. Robinson 100

TRANSMISSION-Operation
LOUISIANA P&L DECIDES ON VERTICAL BUNDLING
H. L. Deloney and W. L. Rush 102

GENERATION-Design
CATHODIC PROTECTION CUTS REPAIRS.....J. B. Primo, Jr 104

DISTRIBUTION-Design
RESIDENTIAL DISTRIBUTION ADAPTABLE.....F. E. Andrews 107

SYSTEM ENGINEERING-Protection
90 DEG RELAY CONNECTIONS URGED...J. L. Mills and H. P. Dupuis 114

EDITORIAL AND COMMENTARY

Editorials 85
Book Reviews 168
Readers Forum 202
Washington Comment 204
Technical Notes 204

INDUSTRY NEWS

Electrical Week 86
Current Events 88, 145
Manufacturers and Markets.. 173
News about People..... 180
Sales Assignments 184
Meetings Calendar 186

MANAGEMENT

Public Relations 200
Finance and Regulation..... 206
Statistics 209

EQUIPMENT NEWS

New Equipment 148
Catalogs and Bulletins 160
Technical Literature 166

TRANSMISSION

Design 132

DISTRIBUTION

Construction 126, 127

SUBSTATIONS

Design 123
Maintenance 134

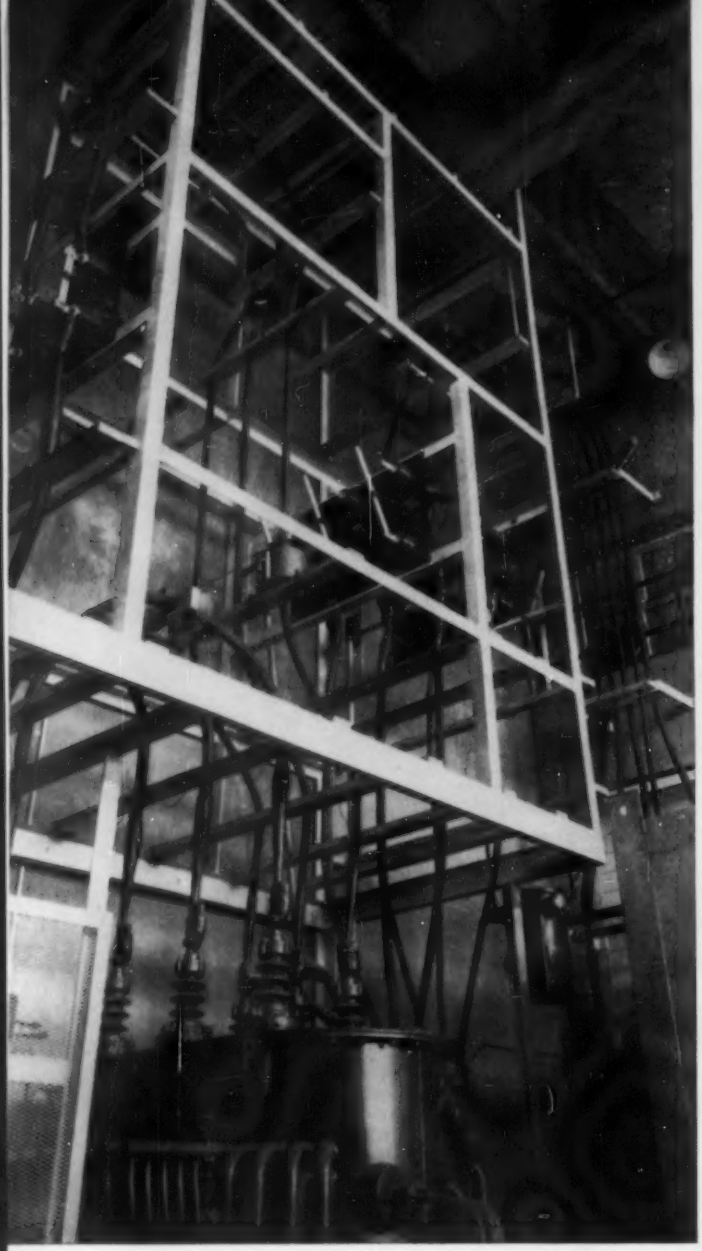
INDUSTRIAL

Operation 138, 140

SALES

Residential 144

INDEX OF ADVERTISERS 211



Okolite-Okoprene 15kv and 5kv cable installed in the Moloney Electric Company's new testing laboratory. The fabricating plant is also wired with Okolite-Okoprene. Gamp Electric Company, St. Louis, Missouri, made the electrical installation.

why Moloney uses OKONITE cables

For their St. Louis plant, Moloney Electric chose Okolite-Okoprene cables—not only for supplying power in their production department, but also for testing their large power transformers. In manufacturing operations of this important nature, the electrical circuits must have two major characteristics—reliability and long life. Here is detailed proof that Okolite-Okoprene cables fulfill these requirements:

1. Okolite insulation's established service record of more than thirty years standing has demonstrated its continued high dielectric strength at a-c voltages up to 35kv and d-c voltages up to 150kv.

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3. Both Okolite and Okoprene are applied by the strip-insulating process which assures metal mold-cured cables, with full, uniform walls of insulation.

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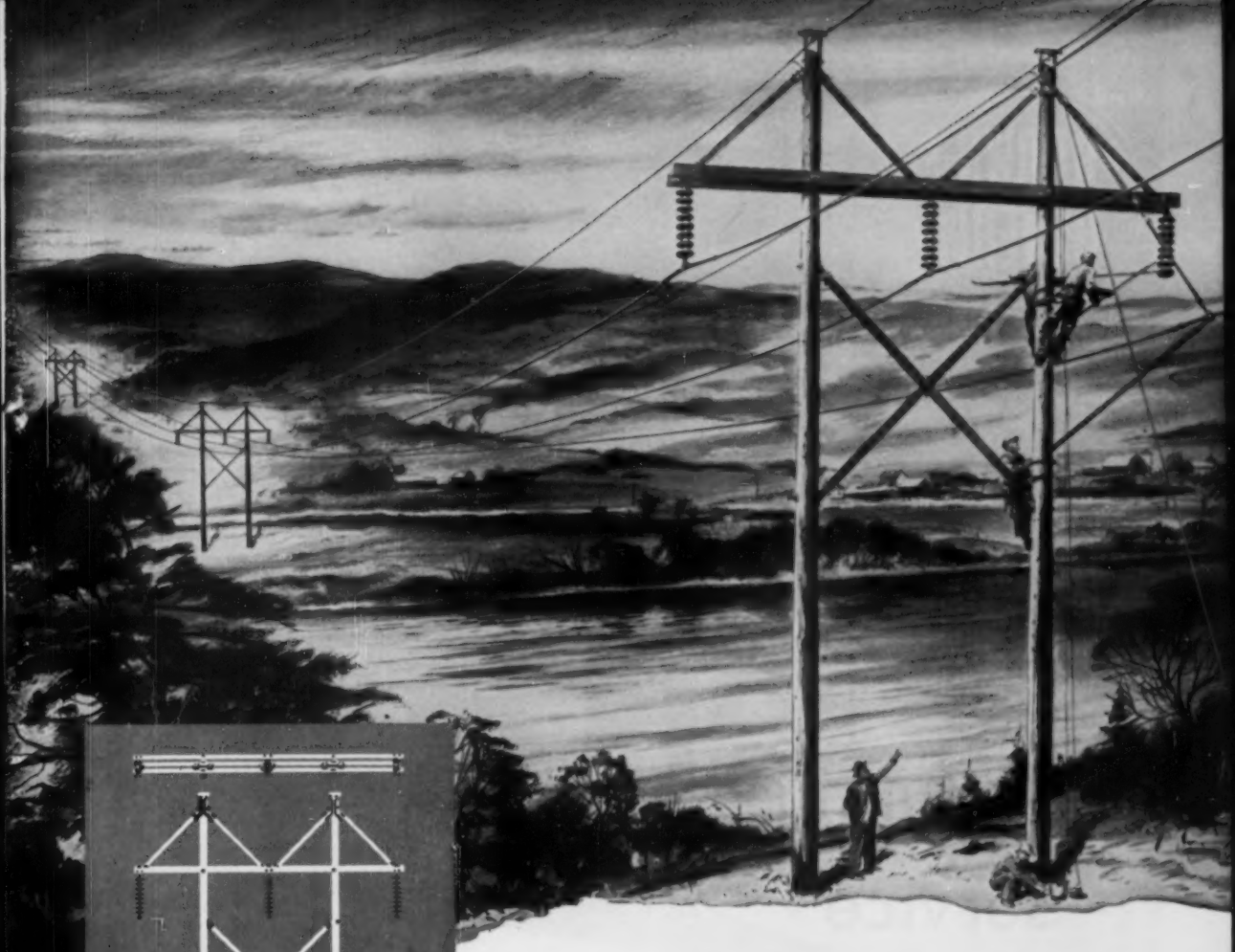

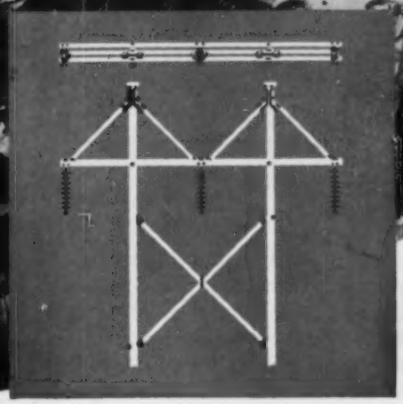

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Quantity	Description
2	Crossarm
3	Steel spacer w/mounting bolts
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1	Bent stud bolt ⅞" x 8" w/2 sq. nuts
2	Bent bolt ⅞" x 5½" w/sq. nut
4	Vee Brace 3⅜" x 4⅜" cross section
1 set	Cross brace w/fittings, clamp, ⅞" pole bolts, curved washers
2	Static wire support
4	Machine bolt ¾" w/locknuts
2	Clevis
2	Suspension clamp for static wire
as req'd	Suspension insulators & fittings

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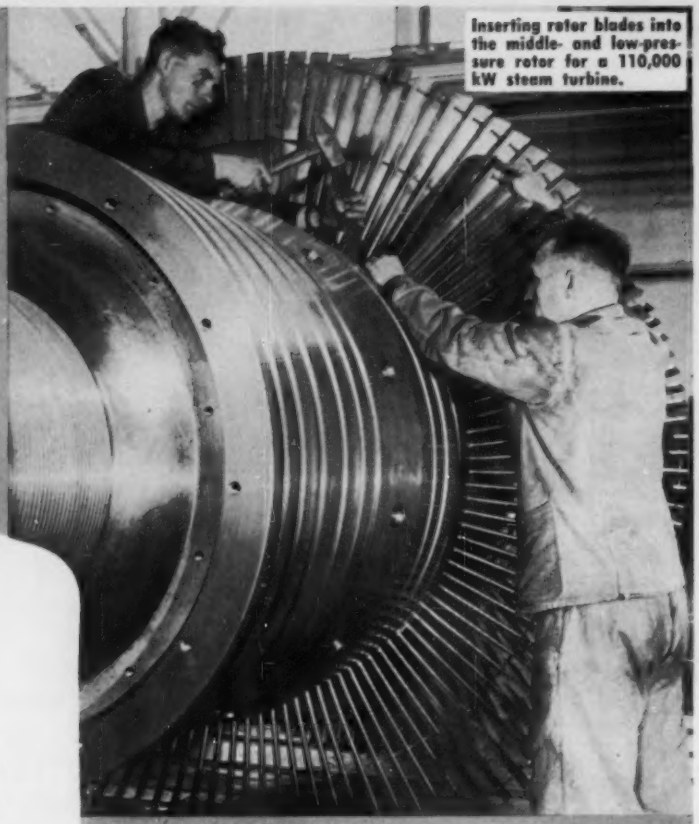

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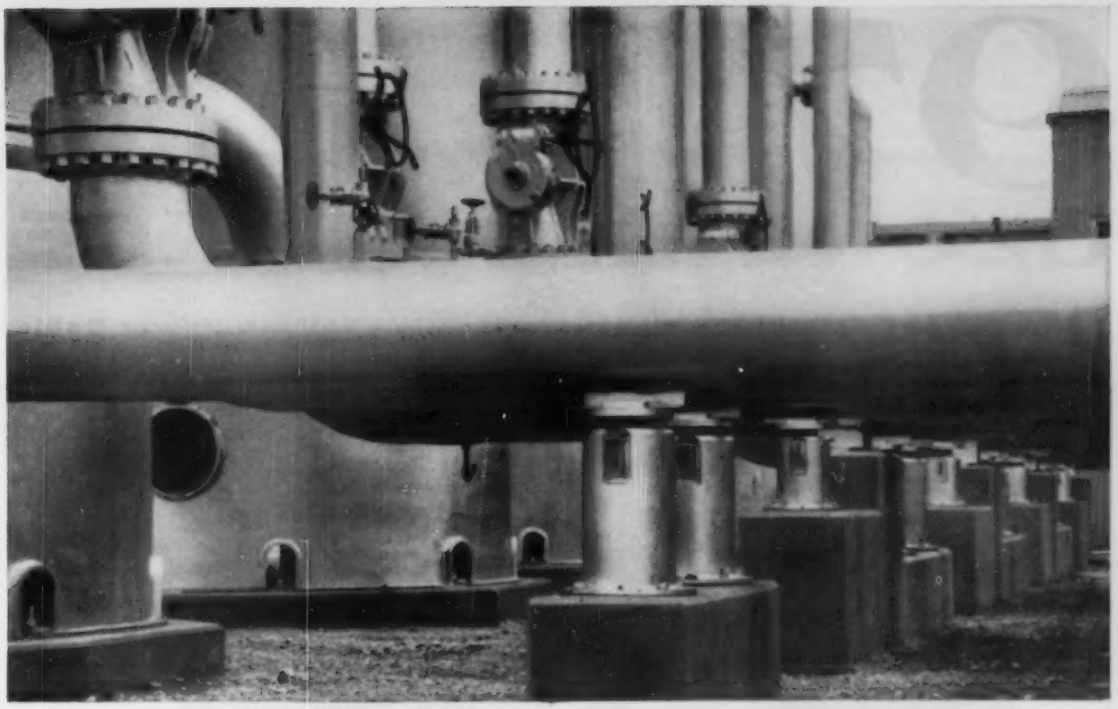

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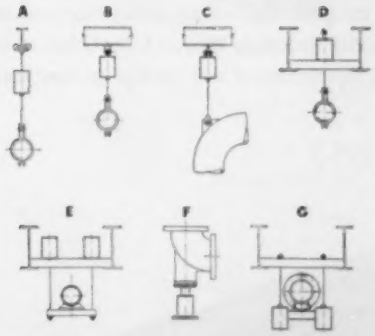

(Type A) Rod threaded to top cap (Type B) Furnished with single lug (Type C) Two lug style (Type D) Top adjusting (Type E) Adjustable top and bottom (Type F) For base support (Type G) Trapeze assembly.

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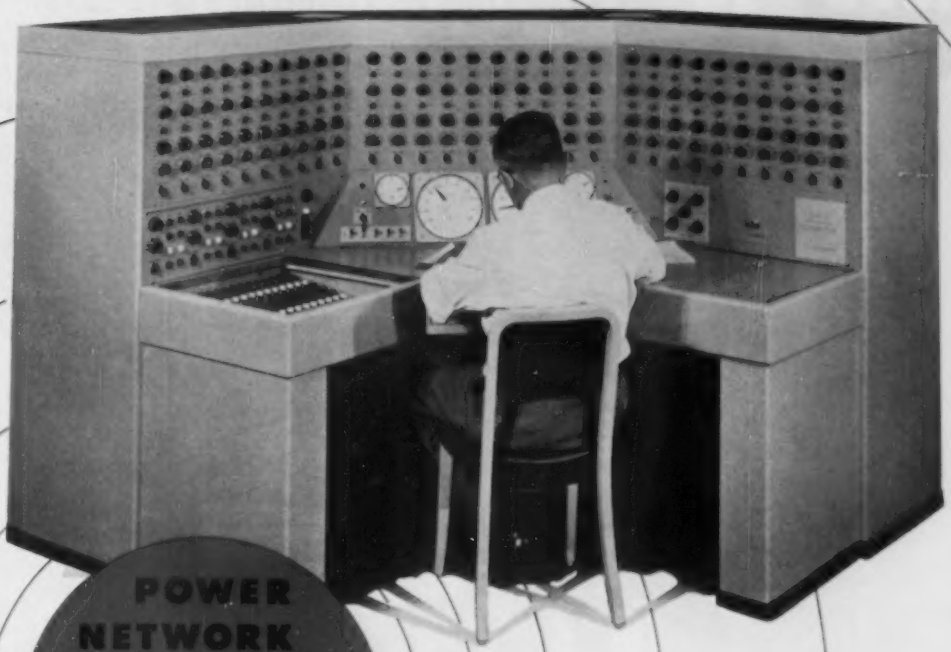

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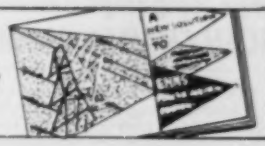

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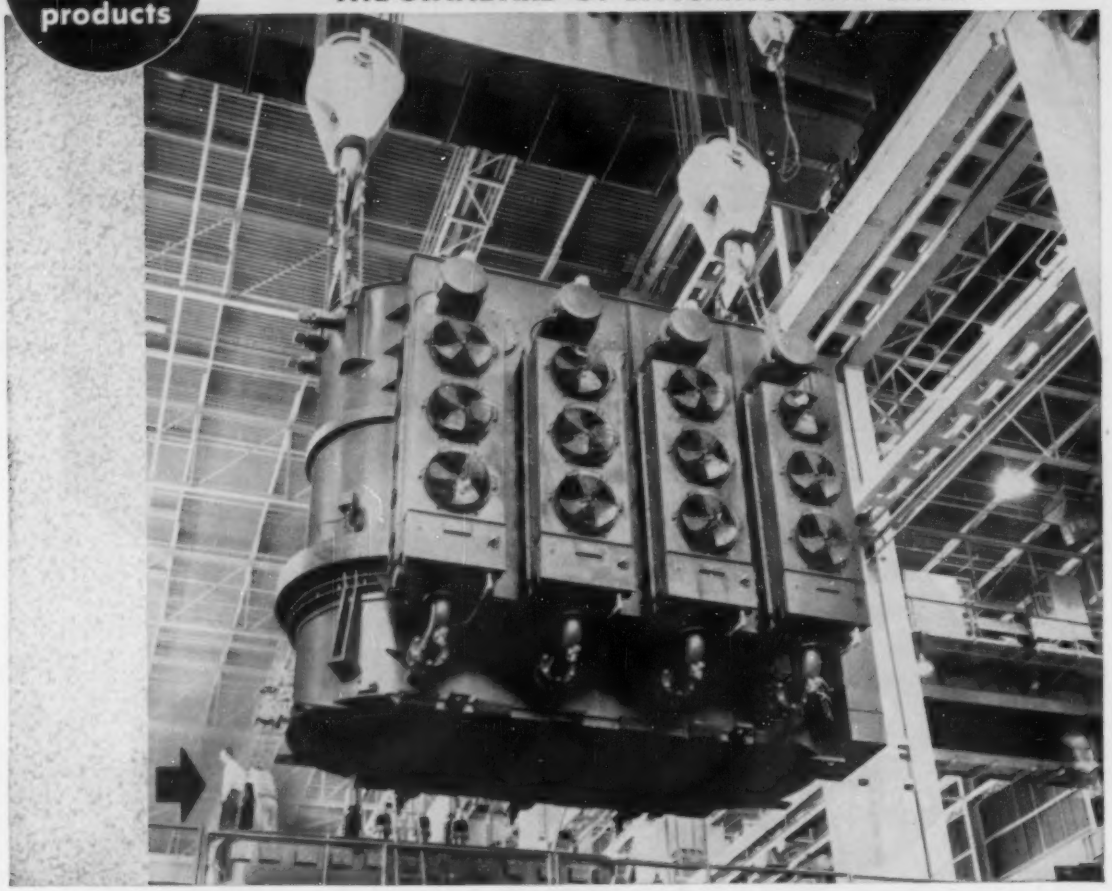

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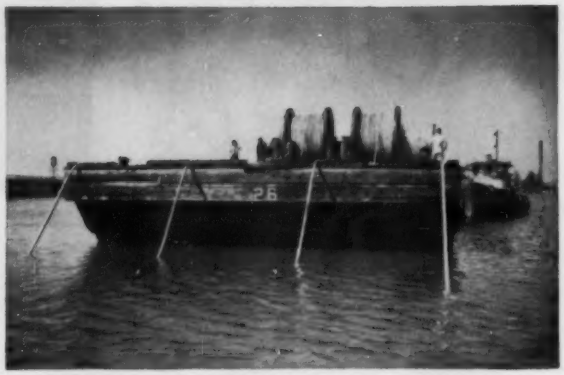
FIRST INSTALLATION in the Tiger Brand Submarine

The first step. Cable is winched to shore where it is terminated at top of pole. This is only one of four such cables.



Barge begins to move across river. The four cables are kept about 10 feet apart all the way. 4th cable is a spare for future use.

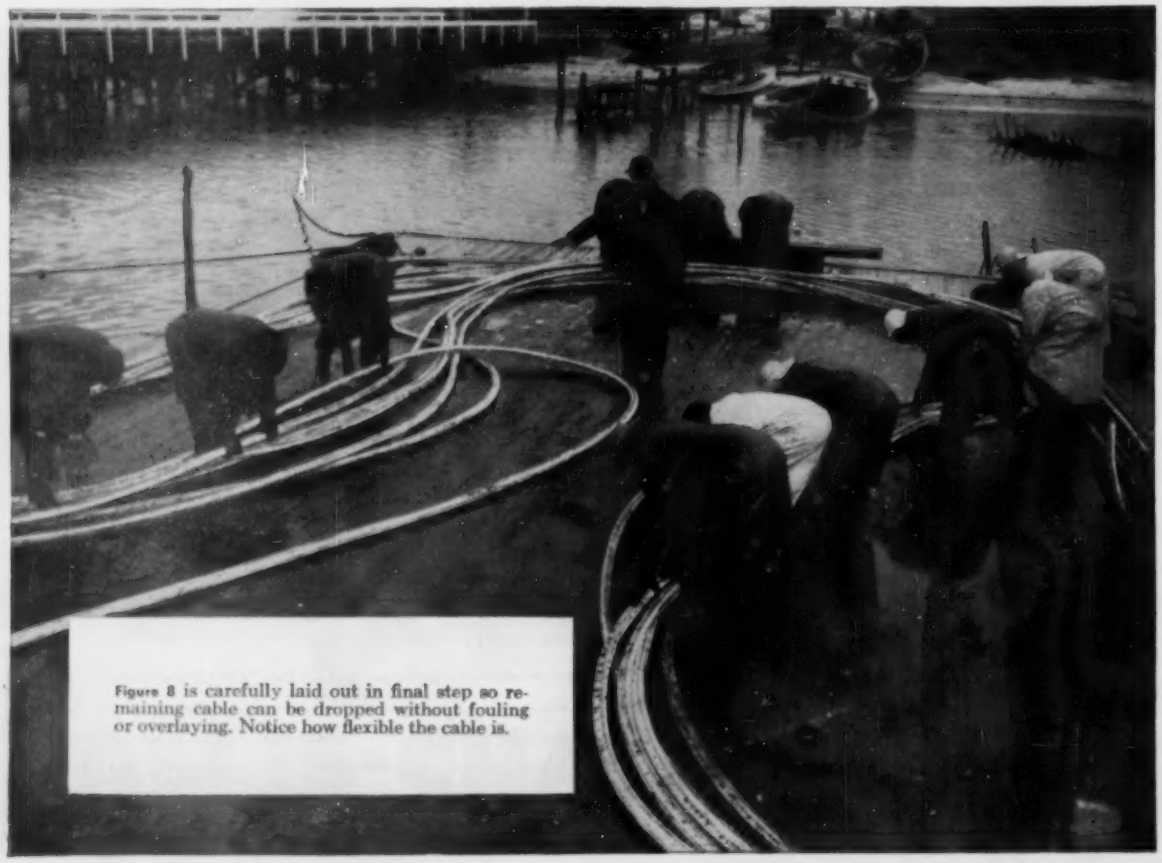


Figure 8 is carefully laid out in final step so remaining cable can be dropped without fouling or overlaying. Notice how flexible the cable is.

United States:

Cable with aluminum armor —in salt water

VIRGINIA ELECTRIC & POWER COMPANY has been using Tiger Brand for 31 years—but the installation shown here features a radical departure from standard cable constructions. To span the brackish Elizabeth River, VEPCO sunk four 3000 ft. single conductor 500 MCM paper lead cables rated at *38,000* volts. The armor is #6 BWG aluminum alloy type 52S-H34, covered with asphalt and jute.

This new aluminum armor is 70% lighter than conventional armor, so it will be much easier to lift the cable if it fouls. The company expects 20 to 30 years of service from the cable.

Why they picked aluminum armor: Because of its non-magnetic properties, the aluminum armor reduced power losses, and it reduced reactive voltage drop. The light weight was also a factor, since it made repairs easier. Extensive tests indicated that corrosion would not be a problem, even in these saline waters.

Just name your expected operating conditions—and there's a good chance that we can supply a standard Tiger Brand cable to do the job. High voltage underwater power cable, flexible dredge cable, cable for power shovels, mine cars or portable hand drills . . . Tiger Brand is designed for those unusual applications where highest possible quality is a must. Call your American Steel & Wire representative.

Here, J. F. Crofton, an independent diver, goes to the bottom to check for fouling. Cables lie in 5 to 10-foot-deep trench, will operate at 34.5 KV.

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- shovel & dredge cable
- paper & varnished cambric cable
- machine tool & building wire
- special purpose wire & cable

USS Tiger Brand **ELECTRICAL WIRE & CABLE** USS

UNITED STATES STEEL

Merry Xmas!

and ... Our New Years wish — for a wealth of happiness and prosperity for the coming year —— many, many thanks for the pleasant associations during the year 1955.

YOUR INDEPENDENT INSULATOR MANUFACTURER

PP INC.

Porcelain Products, Inc. / **Parkersburg, West Virginia.**

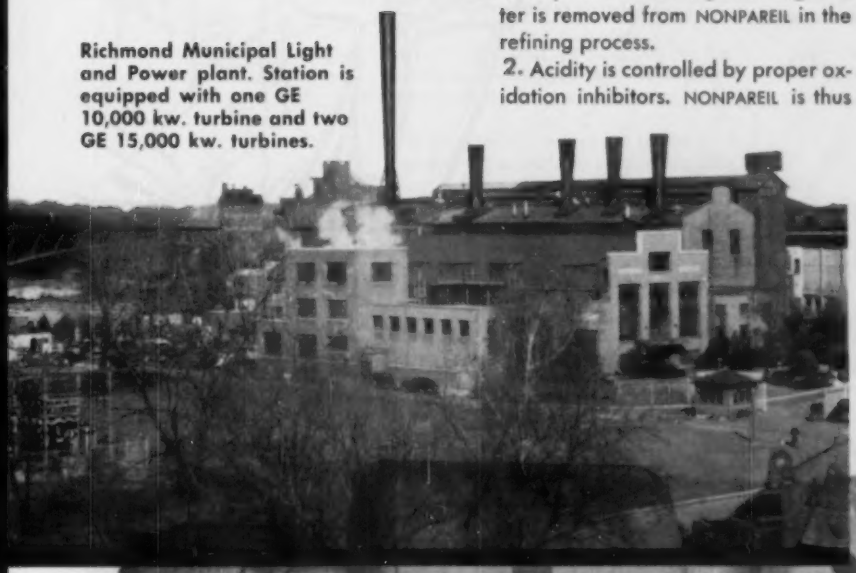
NONPAREIL *in service 21 years— no worries about turbine oil failure at Richmond*

Richmond, Indiana, Municipal Light and Power plant, first installed NONPAREIL Turbine Oil in two GE turbines in 1934. One turbine is 10,000 kw., the other 15,000 kw. The same NONPAREIL Turbine Oil—plus usual makeup—has been in service in these turbines ever since. Another 15,000 kw. turbine installed in 1948 has also used NONPAREIL since start up. In each unit NONPAREIL has lived up to its guarantee to last for however long the turbines are in service.

NONPAREIL Turbine Oil can deliver this outstanding service because:

1. Asphaltene or sludge forming matter is removed from NONPAREIL in the refining process.
2. Acidity is controlled by proper oxidation inhibitors. NONPAREIL is thus guaranteed never to exceed an acidity level of 0.15 mg. KOH/g. In most cases oil acidity is maintained at levels near 0.05 mg. KOH/g.

Want to know more about NONPAREIL Turbine Oil? In the Midwest, call your nearby Standard Oil office. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Ill.



Richmond Municipal Light and Power plant. Station is equipped with one GE 10,000 kw. turbine and two GE 15,000 kw. turbines.

NONPAREIL Turbine Oil has lived up to guarantee for 21 years in two turbines at Richmond, Indiana. Another turbine has used NONPAREIL 7 years.

STANDARD

STANDARD OIL COMPANY (Indiana)

"When our main feeder single-phased, we did not lose a motor — FUSETRON DUAL-ELEMENT FUSES saved them"

"In October, 1952, we had quite a demonstration on how Fusetron dual-element fuses can prevent motor burn outs.

"Fusetron fuses that we were using to back up our motor protection began popping out all over the plant because our main feeder circuit had single-phased.

"Before we could dump the whole plant by pulling the main switch, sixty-seven Fusetron fuses had opened.

"We did not lose a single motor, however, and while it was some trouble to us to replace all the blown Fusetron fuses, we would rather do that than repair one burned out motor.

"We are convinced that Fusetron fuses used to back up our other motor protection, give us a distinct advantage in saving time and money.

Samuel T. Craig CHIEF ELECTRICAL ENGINEER
JUDSON L. THOMSON MANUFACTURING CO.
WALTHAM, MASSACHUSETTS

FUSETRON dual-element FUSES DO MORE THAN PROTECT MOTORS AGAINST BURNOUT DUE TO SINGLE PHASING

. . . *They provide 10 Point Protection*

1. High interrupting capacity — protect against heaviest short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.

2. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.

3. Protect against needless blows caused by harmless overloads.

4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5. Protect against waste of space and money — permit use of proper size switches and panels.

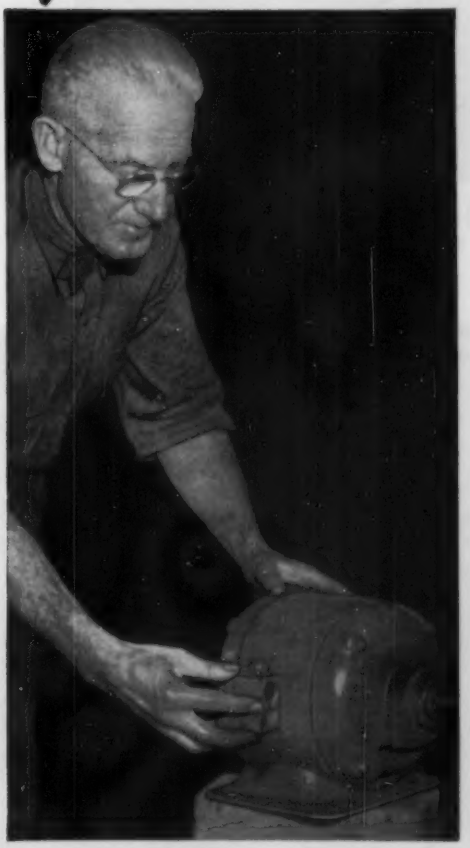
6. Protect motors against burnout from overloads.

7. Give DOUBLE burnout protection to large motors — without extra cost.

8. Protect motors against burnout due to single phasing.

9. Make protection of small motors simple and inexpensive.

10. Protect coils, transformers and solenoids against burnout.



AND FUSETRON FUSES REMAIN SAFE

without maintenance and recalibration costs

Once properly installed, Fusetron fuses require no costly inspection time or maintenance necessary on mechanically operated devices.

Dust, fumes, corrosion or age cannot prevent a Fusetron fuse from opening safely. There are no hinges, pivots or contacts to stick or slow down the operation of the fuse on short-circuit.

When a Fusetron fuse does open to protect, and after the fault has been corrected — the new Fusetron fuse you install has been calibrated at the factory by engineers — it is a fuse as safe and dependable as the one that blew.

Blowing time charts and more information are available on Fusetron dual-element fuses. Write for bulletin FIS.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS . . . *Use BUSS Hi-Cap Fuses*

On 600 volts or less, they have interrupting capacity sufficient to handle any fault current regardless of system growth.

When coordinated with Fusetron fuses they will not open ahead of fuse nearest fault.

— Write for bulletin HCS —

Play Safe! *Install FUSETRON Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!*

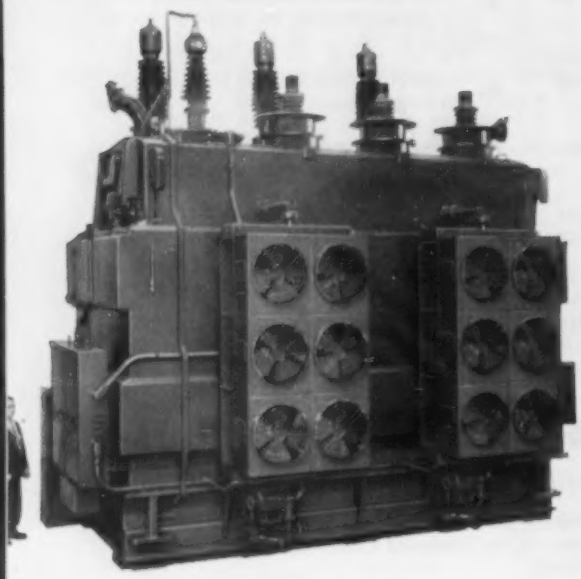
FUSETRON
BUSS

1255

BUSSMANN Mfg. Co. *Division of McGraw Electric Co.*
University at Jefferson, ST. LOUIS 7, MO.

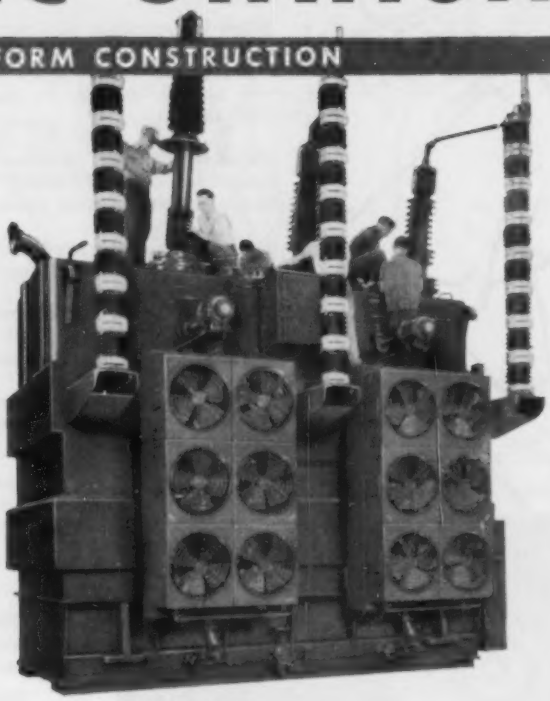
MAIN STEP-UP
GENERATING STATION

CONTOUR-DESIGN, SHELL-FORM CONSTRUCTION



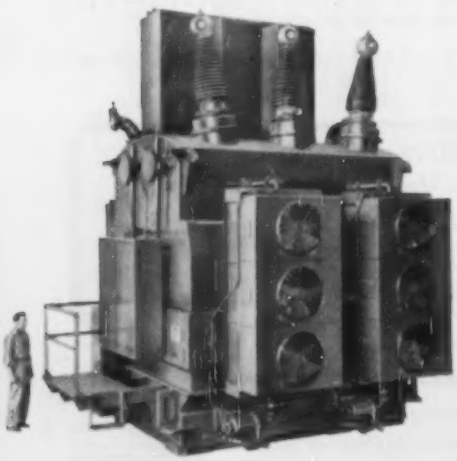
175,000 Kva 3 PHASE

High Voltage: 115,500 Grd. Y volts
Low Voltage: 17,500 Delta volts
Oil-immersed, forced-oil-cooled with forced-air cooler



140,000 Kva 3 PHASE

High Voltage: 115,000 Grd. Y volts
Low Voltage: 14,700 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air-cooler



120,000 Kva 3 PHASE

High Voltage: 145,000 Grd. Y volts
Low Voltage: 19,800 Delta Volts
Oil-immersed, forced-oil-cooled with forced-air cooler

CORE-FORM CONSTRUCTION

56,000/70,000 Kva SINGLE PHASE

High Voltage: 93,000/161,000 Grd. Y volts
Low Voltage: 19,000 volts
Oil-immersed, self-cooled/forced-air-cooled

TRANSFORMERS

BY

PENNSYLVANIA

. . . pioneer of 1-piece shipment of large power transformers

The three main step-up transformers pictured at the left are "giants" from the standpoint of kva capacity — ranging from 120,000 kva to 175,000 kva. In physical size, however, their dimensions and weights were kept well within the limits for *one-piece shipment.* This was possible because of the extreme compactness of Pennsylvania's own "contour design" shell-form construction.

The units traveled to their respective installation sites in an upright position, with only bushings, cooling equipment and certain accessories removed. This meant easier handling in the field, with greatly reduced installation time and costs.

Station Auxiliary TRANSFORMERS

2,000 Kva SILICONE-INSULATED DRY-TYPE TRANSFORMER

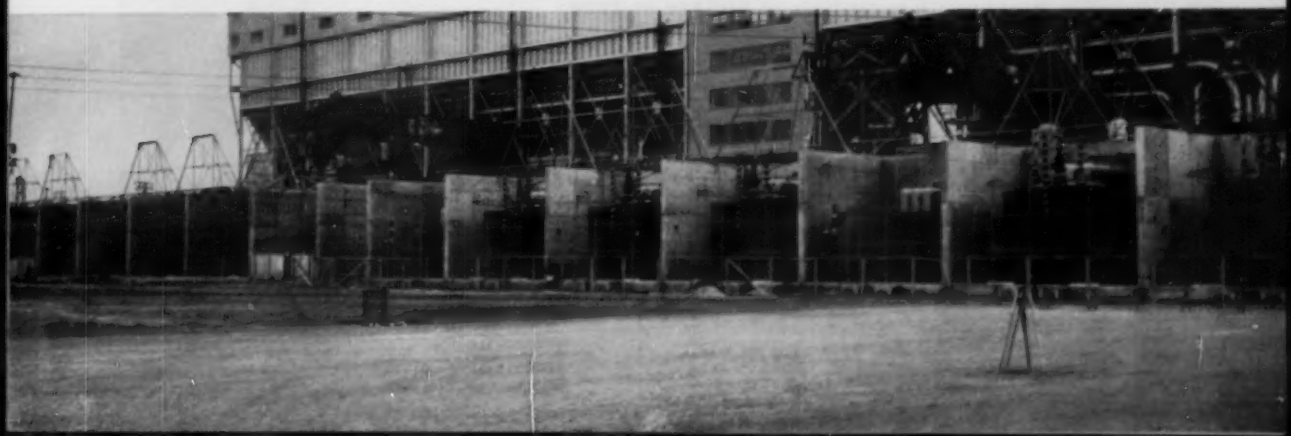
Just as Pennsylvania led the way in one-piece shipment of large power transformers, the company also pioneered the development of silicone-insulated units —the fire- and explosion-resistant transformers that are safest of all for both indoor and outdoor installations.

The 2000 kva station auxiliary unit pictured is believed to be the largest silicone-insulated (formerly "Class H") transformer ever built. It is a group 3, sealed-in nitrogen, dry-type unit; three phase, 60 cycles, 150°C. temperature rise; 2400Δ—480Δ volts.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

As the *pioneer* of one-piece shipment of large power transformers, Pennsylvania has long been offering this time-saving, cost-cutting advantage with *core-form* transformers as well as with contour-design (shell-form) units. For example, the nineteen 56,000/70,000 kva main step-up generating station transformers pictured here were shipped to their destination in an upright position, completely assembled except for bushings and detachable radiators.



Phelps Dodge will help you meet your Expanding Power Cable Needs!

PRACTICAL EXPERIENCE IN RESEARCH, COMPLETE RANGE OF HIGH

THE electrical utility industry is constantly being called upon to increase its generating capacity. Phelps Dodge is meeting this high-voltage power cable expansion program with research, design and manufacturing know-how. Year after year, Phelps Dodge has met utility demands for cables with high-voltage ratings and greater carrying capacities. Phelps Dodge's experience, research facilities and engineering skill are the answer to your cable requirements regardless of voltage or type.

**Electrical World*

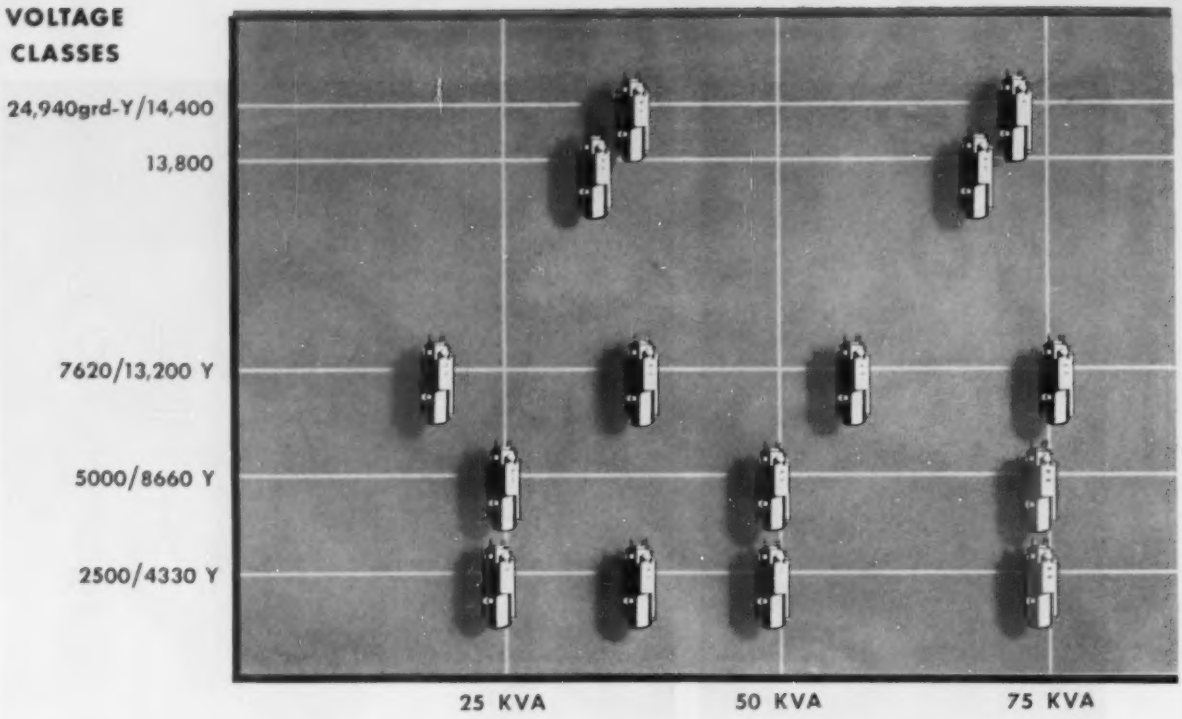
PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

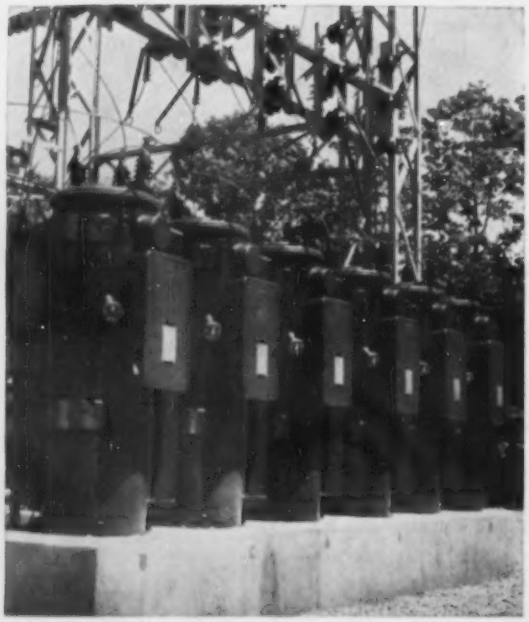
DESIGN AND MANUFACTURE OF A VOLTAGE POWER CABLES !

69 KV... to... 230 KV

Typical examples of Phelps Dodge power cables engineered to meet modern utility power requirements. On the left: self-contained, three-conductor, medium pressure, gas, 69 KV cable. On the right: the highest voltage cable to be installed in the United States, a pipe-type, three-conductor, oil compression, 230 KV cable.



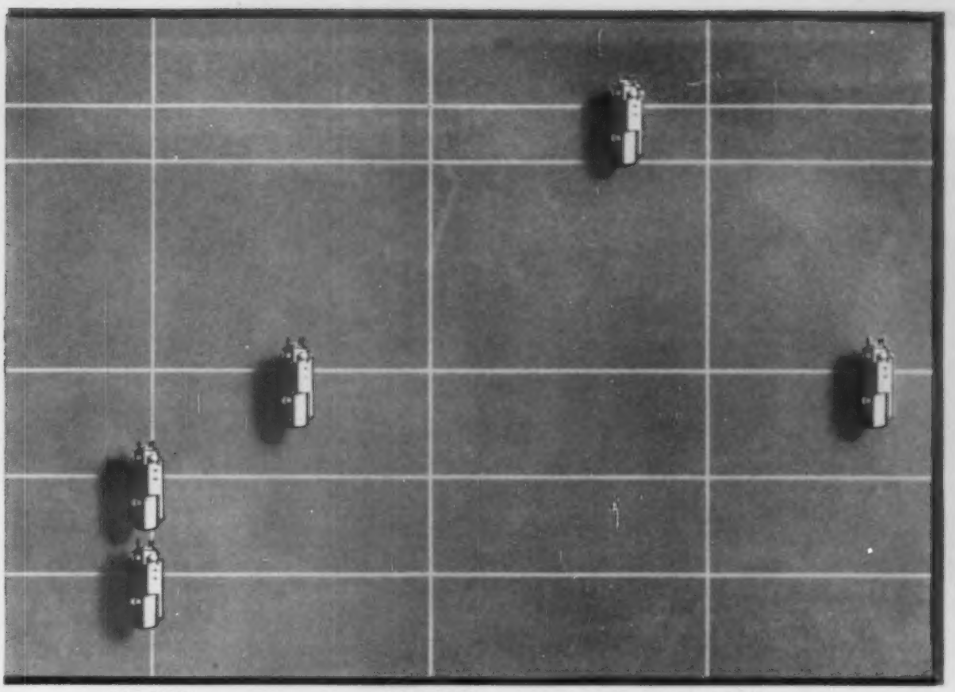
Now... General Electric doubles KVA



SINGLE-PHASE ML32 step-type feeder voltage regulators provide 10% raise and 10% lower in 32, ⅝% steps.

KVA RATINGS and CURRENTS

VOLTAGE	KVA	AMPERES at ±10% (rating)	AMPERES at ±5%
2500/4330 Y	25.0	100	160
	37.5	150	240
	50.0	200	320
New	75.0	300	400
	100.0	400	400
5000/8660 Y	25.0	50	80
	50.0	100	160
New	75.0	150	240
	100.0	200	320
7620/13,200 Y	19.1	25	40
	38.1	50	80
	57.2	75	120
	76.2	100	160
New	114.3	150	240
	167.0	219	350
13,800 New	34.5	25	40
	69.0	50	80
24,940grd-Y/14,400	36.0	25	40
	72.0	50	80
New	144.0	100	160



100 KVA 125 KVA 150 KVA

7 new ratings give you a new opportunity to provide low-cost regulation on your growing feeders.

# of single-phase step regulators

and OFFERS INCREASED CURRENT CAPACITY AT ±5% WITH MULTI-AMP

Now you can get G-E, single-phase step feeder voltage regulators, in four voltage classes, with doubled KVA ratings. Seven new, larger sizes enable you to more economically provide better voltage control on your heavily loaded feeders.

In addition, you get a 60% bonus with this line of G-E 32-step regulators, as they will carry 160% of rated current (up to a limit of 400 amperes) when operated at ±5% regulation. Providing additional capacity on your heavily loaded feeders, these regulators help assure customer satisfaction and give you an increased dividend by holding good voltage for less investment. **Compare the relative costs** of these new regulators with other regulating methods. For instance, the price of regulators in this extended range of ML32's for three-phase service, even including individual phase control, as a standard item, *is less than the costs of other types of comparable bus regulation.*

These new regulators include all the quality features of the General Electric ML32 regulator family that give greater accuracy, longer life and superior service. Plan now to take advantage of the low first cost of these outstanding feeder voltage regulators. They can be installed on poles or platforms or in substations. Ask your G-E Apparatus Sales Engineer or Agent for price and shipment information. General Electric Co., Schenectady 5, New York. 423-8

Progress Is Our Most Important Product

GENERAL ELECTRIC

Modern Truck Features

Chevrolet trucks have got it! A full list of modern features that mean better business—on the job today and at trade-in time tomorrow!

When you get right down to it, anything *less*, any truck without all of Chevrolet's Task-Force features is still living in the past. Why risk losing money with an old-fashioned truck—when you can get a Task-Force model with the industry's most advanced features? Features that boost efficiency and bring you big-dollar savings!

Most modern power—V8 or 6. There's longer life in Chevrolet V8's. With their short-stroke design—shortest of any leading truck—you can count on less friction and wear per mile. V8 is standard in the new L.C.F. model, available in all other

NEW CHEVROLET

that Mean Business!

models, except Forward Control, as an extra cost option.

If you go for sixes—Chevrolet's gas-saving valve-in-head sixes are famous for their dependability. All engines are sparked by a modern 12-volt electrical system for quicker starting and smoother going!

Most modern comfort and safety features. Chevrolet's got them all—panoramic windshield, new High-Level ventilation, softer seat action, concealed Safety Steps—new truck advances that make the driver's job less of a chore . . . modern features that keep driver efficiency up and your trucks on or ahead of the tightest schedules.

Most modern chassis features. New, more rigid ladder-type frames that bear up better under long, tough going. New suspensions that smooth rough roads, benefiting both the driver and the cargo. Tubeless tires standard on ½-ton models. Power Brakes standard on 2-ton jobs, optional at extra cost on others. Power Steering available on most models as an extra-cost option.

See your Chevrolet dealer for details on the Task-Force truck that's best for your operation. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Task-Force TRUCKS

NEW UTILITY STATIONS, C-E EQUIPPED

Includes only *new* stations on *new* sites placed in operation since JANUARY 1, 1950.

LAKE CATHERINE
HUTCHISON
YATES
DUNKIRK
TITUS
LEE
CONTRA COSTA
HAWTHORN
NINEMILE POINT
EDGE MOOR
PALATKA
JOHNSONVILLE
DANSKAMMER
BECKJORD
HIGHGROVE
PLANT X
BLACK DOG
ALBANY
JOPPA
MERAMEC
PORTSMOUTH
LAKE CREEK
ETIWANDA
AURORA
HENNEPIN
EASTLAKE
OAK CREEK
SUWANNEE RIVER
URQUHART
KINGSTON
SANDOW
MULLERGREN
BARRY
NORTH OMAHA
WILMINGTON
CARBON
SAGUARO
MORRO BAY
VERMILION
JOHN SEVIER
COLLIN

MILLIKEN

NEW MILLIKEN STATION

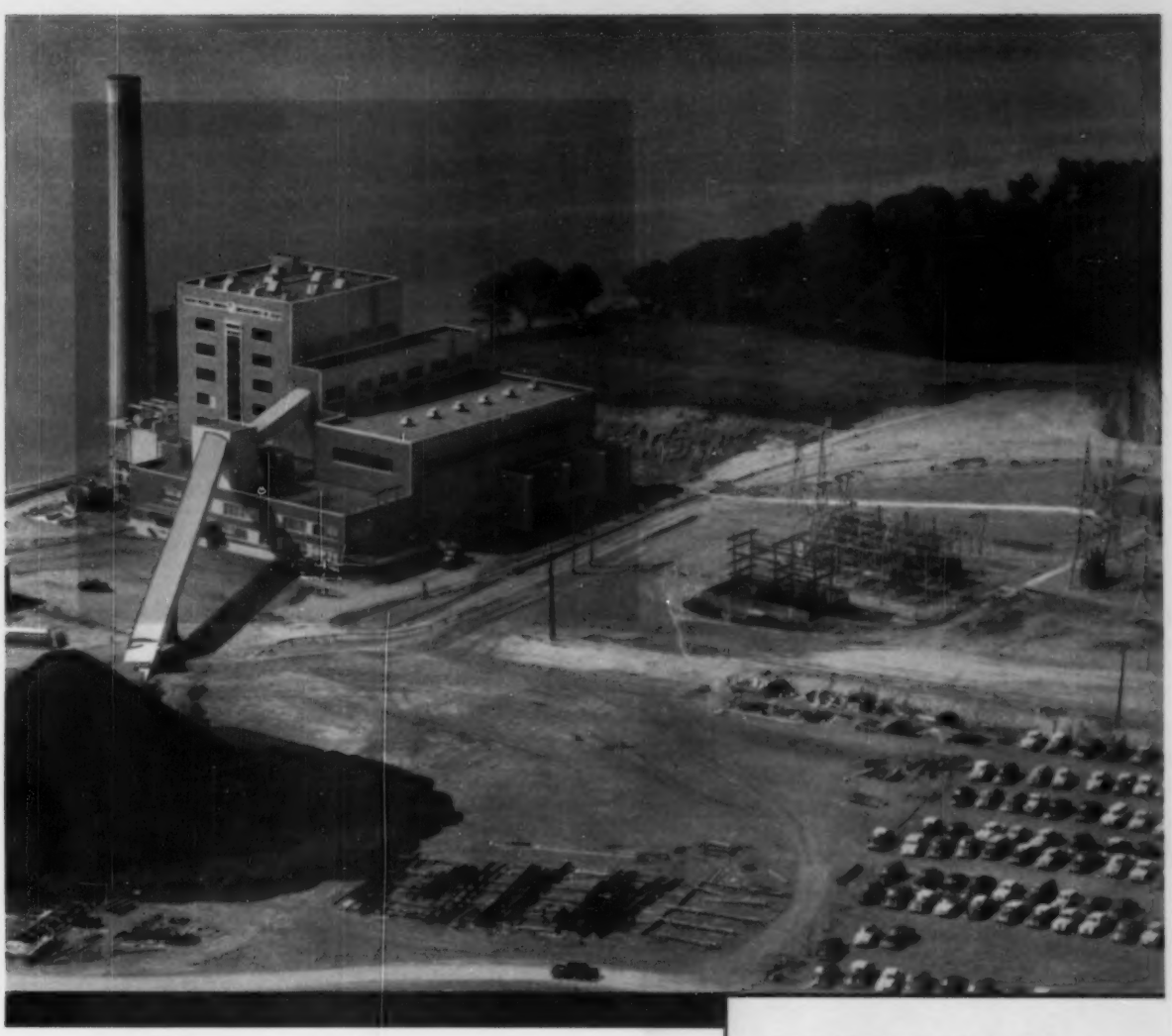
...now in service

Milliken Station joined the New York State Electric and Gas Corporation's system on October 22, when Unit No. 1 was placed in service.

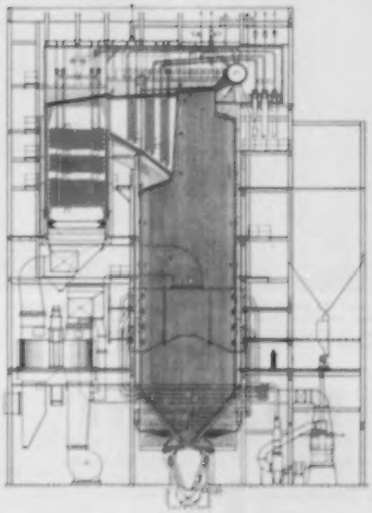
This attractive, new generating plant is ideally located 17 miles north of Ithaca on Cayuga Lake near the center of the system load. The new unit at Milliken Station—nameplate capacity 135,000 kw—is the third (and largest) reheat unit to be placed in operation by New York State Electric and Gas Corporation. It raises the system steam generating capacity to 689 MW.

The site anticipates the addition of five units, but all necessary service facilities—machine shop, store room, basic coal handling, etc., have been provided for the future expansion. Gilbert Associates, Inc. are the engineers.

The new turbine-generator is served by a C-E Radiant Reheat Boiler Unit a cross-sectional elevation and brief description of which appear on the opposite page. B-555



Shown at right is the C-E Unit now in service at the Milliken Station. It is of the radiant-reheat type with a reheater section located between the primary and secondary superheater surfaces. An economizer section is located below the rear superheater section and regenerative type air heaters follow the economizer surface. These units are designed to supply steam at a throttle pressure of 1800 psig with primary steam temperature at 1005°F, reheated to 1005°F. They are pulverized coal fired using bowl mills and tilting, tangential burners. Arrangements are made for alternate use of oil as required.



COMBUSTION ENGINEERING

C-E

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

HOMELITE

5-20

CHAIN SAW

It's NEW... It's alive with power

5 HP—20 POUNDS

Never before has there been a chain saw with so much power per pound as the new Homelite Model 5-20. It has 5 big horsepower for faster cutting . . . a light, light 20 pounds for easy operation. What's more, it is the only chain saw that gives you a choice of attachments to do many different cutting chores easier.

The new Homelite Model 5-20 is precision built for quick starting, dependable performance, and low, low maintenance. Cuts in any position . . . it saves both time and money . . . brings bigger profits to woodcutting or clearing operations. Write for complete details or see your Homelite dealer.

See your dealer for details on the Homelite TIME PAYMENT PLAN

Packed with power, the new Homelite Model 5-20 Chain Saw brings down big trees six feet in diameter, cuts through 20" trees in 20 seconds without forcing or jamming. Anyone can operate it . . . no experience necessary.

DO MORE WITH THESE 5-20 ATTACHMENTS

Interchangeable Blades add versatility to the new Homelite 5-20 Chain Saw. For felling, bucking, limbing or plunge cutting, there's a hard track blade for every requirement. Straight blades available from 14" to 60", bow saws 14" and 18".

Brush Cutter cleans out brambles, brush, undergrowth and small saplings six times faster than conventional methods. The adjustable harness, hanger and handle bars assure perfect balance . . . make it extremely simple to operate . . . safe for anyone.

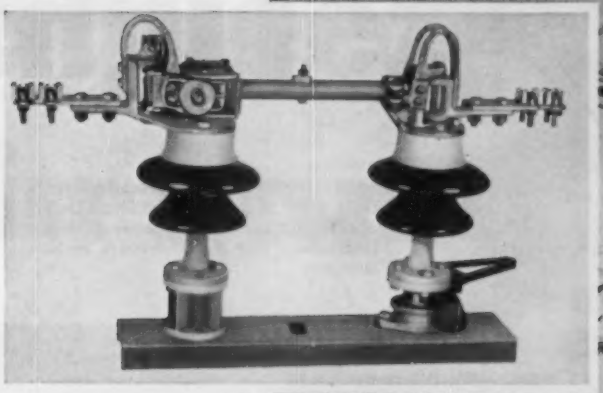
Clearing Attachment makes quick work of clearing land of small trees. Plunge cuts or plunge bucks . . . no bending or stooping . . . less fatigue. One man keeps three men busy carrying away limbs and piling brush!

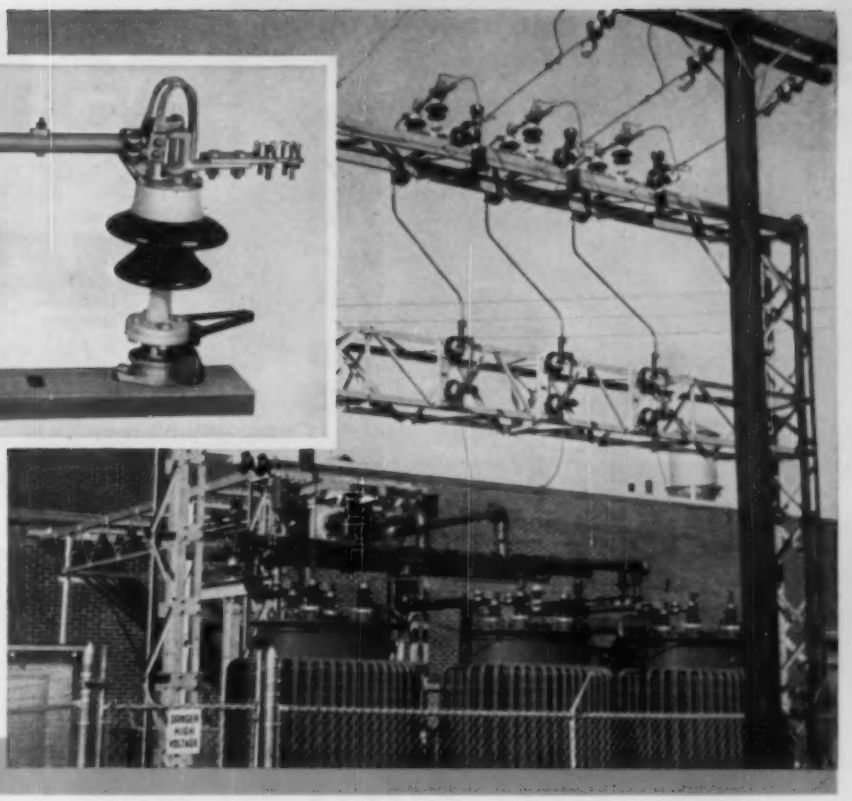
HOMELITE

6112 RIVERDALE AVENUE • PORT CHESTER, NEW YORK

A DIVISION OF TEXTRON AMERICAN INC.

Manufacturers of Carryable Chain Saws • Pumps Generators • Blowers





Southern States' Type 57-K Group Operated Air Break Switches are used in this modern Shelbyville, Tennessee, plant. Self-adjusting line contacts maintain high-pressure permanently. Non-corrosive, greaseless bearings and a minimum of moving parts keep maintenance low. Available in voltage ratings from 7.5—69kv and continuous current ratings from 400—1200 amps. For details, ask for Bulletin 5457K.

U.S. RUBBER IS GOOD EXAMPLE OF HOW NATION'S INDUSTRIES USE SOUTHERN STATES EQUIPMENT

Increased use of power by the nation's expanding industries is calling for more substations and switchyards. Southern States is ideally equipped to handle these applications to the complete satisfaction of industries and suppliers of power alike.

A Shelbyville Power System industrial substation at the U. S. Rubber Co. Plant in Shelbyville, Tennessee, is a good example. Southern States supplied the substation and many components: the type 57-K Group Operated Air Break Switches for disconnecting incoming 15 kv lines; B Series Power Fuses to protect the transformers; connectors and bus fittings which accommodate conductors carrying up to 3500 amps; and heavy-duty, hookstick operated disconnects that provide a means for isolating the station from the plant.

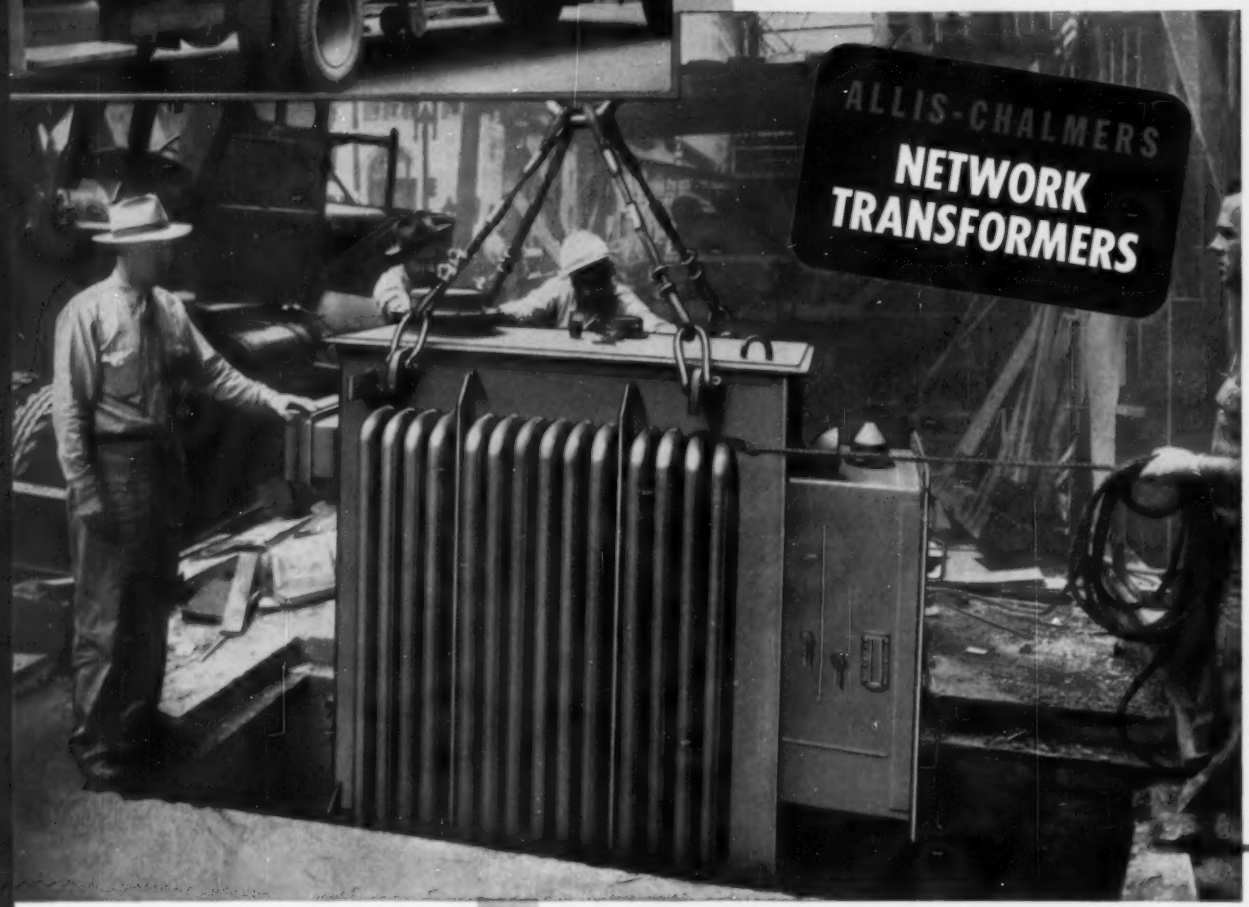
Industries, as well as the nation's leading utilities, look to Southern States for top-quality, functional equipment. It will pay you to specify products made by Southern States.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

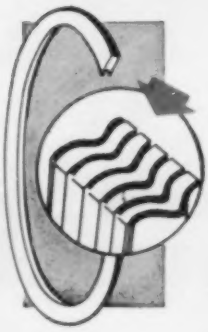
IN CANADA: Dominion Cutout Co., Ltd., Toronto

Tight

Transformers are unloaded from PG&E truck in front of partially finished building at northeast corner of busy Montgomery and Sutter Streets in San Francisco.



Transformer is lowered into much smaller than normal vault. Other three units went into same size vault close by. Low voltages are tied in with PG&E's secondary network system.

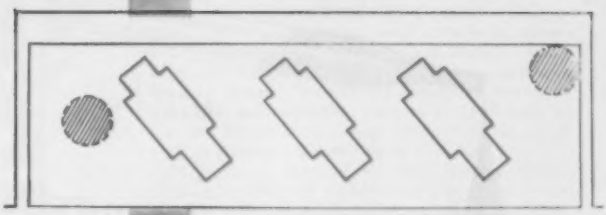


Spiral-wound gaskets. Over 6 years' continual use has proved their superiority over other types of gasketing material for sealing bushings in the tank wall. Alternate plies of preformed spring-like metal and non-metallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cement or grease. They can be quickly removed as required and may be re-used if necessary.

Squeeze in San Francisco

Compact

network transformers and engineering ingenuity solve problem when vault is small



Sketch of vault shows how three 500-kva transformers were fitted into unusually small area.

PACIFIC GAS & ELECTRIC COMPANY'S network engineers had to test their ingenuity to provide power for the new Equitable Life Assurance Company building in San Francisco. It was a tight fit for transformers because building architects limited vault width.

PG&E engineers solved the problem by installing the units at a 45-degree angle. Even then it was a tight squeeze to get six 500-kva transformers in the space allowed.

For a job like this, compact design and reliable operation are vital. Not only must transformers fit into small size vaults, they have to provide trouble-free performance, because maintenance isn't easy.

PG&E used Allis-Chalmers network transformers for the job. These units have proved their reliability in hundreds of installations — over 1½ million kva are now in operation. They have the compact design and rugged construction needed for congested areas.

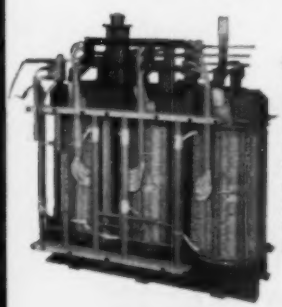
Before you consider your next network installation, get complete facts on Allis-Chalmers network transformers. Call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

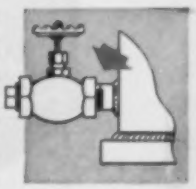
A-4711

Design and Construction Features



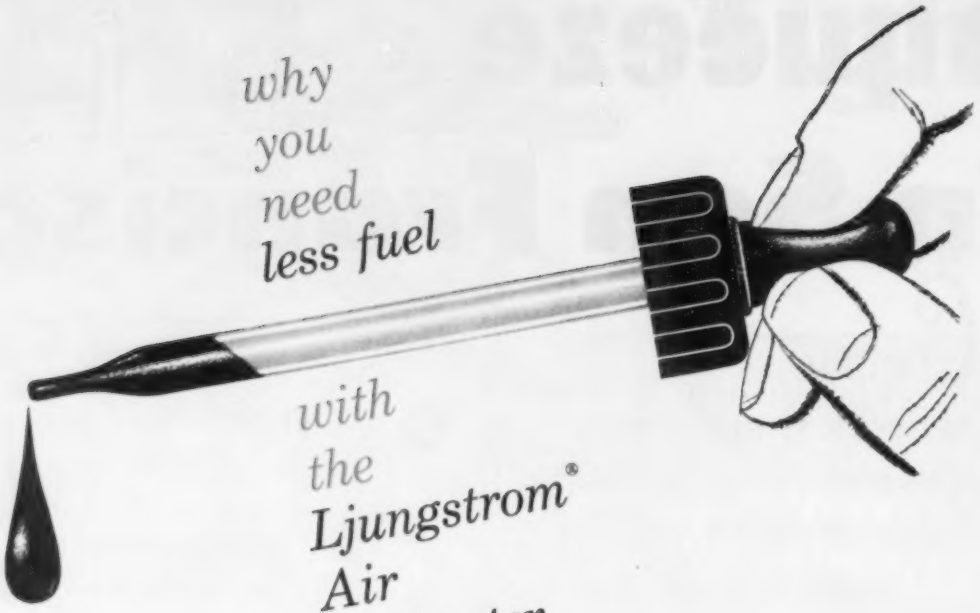
Compact, low-loss design. Thermal capacities are high for contingency load conditions. Sturdy, time-proved core and coil construction meets repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism. Handle inserted through two-inch opening on cover operates the tap-changing mechanism. Handle cannot be removed unless it is in positive tap change position.



Threaded valve connections to tank are tinned for extra protection. Valves are located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

why you need less fuel with the Ljungstrom® Air Preheater

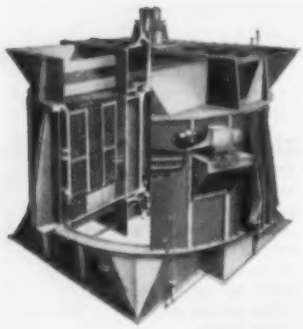


With every 45-50 F of air preheat — you cut your fuel bill 1%. That's why it pays to equip your boilers with Ljungstrom Air Preheaters. For the Ljungstrom is the most efficient air preheater there is.

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

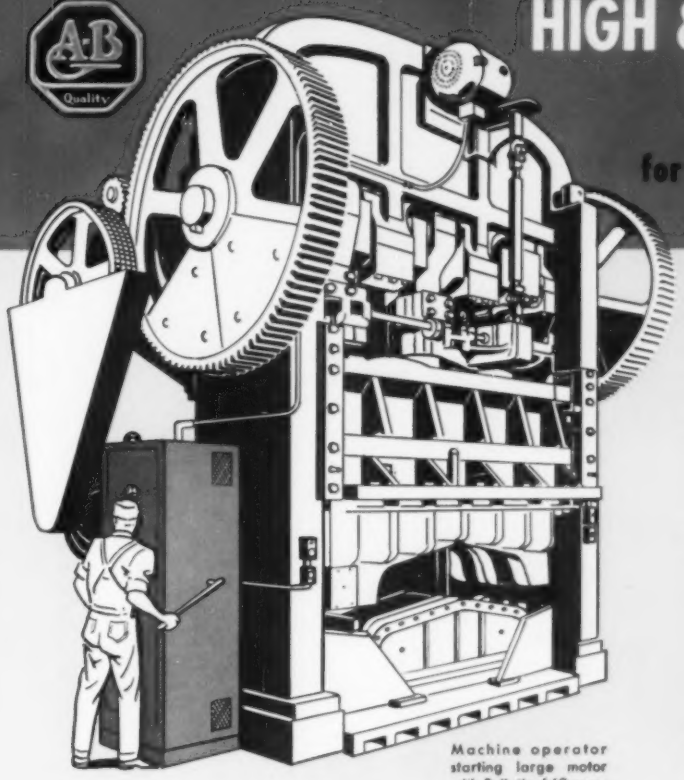
The Ljungstrom also gives industrial plants broad latitude in their choice of fuels. Its unmatched preheating efficiency makes practical and effective such low-grade fuels as saw and paper mill refuse, wood, lignites, peat and bagasse.



Outright fuel economy is reason enough why 7 out of 10 modern preheater installations are Ljungstrom, and why Ljungstrom percentage of installed boiler capacity increases every day. Yet it's just one of the many advantages of the Ljungstrom. Get all the details on why the Ljungstrom cuts fuel costs . . . why it's the most efficient heating surface on the modern boiler . . . why it's easier to clean and maintain. All the details are in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for it, today.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

HIGH & LOW VOLTAGE STARTERS for BIG MOTORS



Machine operator starting large motor with Bulletin 640 manual velvet smooth resistance starter. Starting jolts are eliminated.

BIG STARTERS for big motors . . . for 220-440-550 volts . . . for 2000 to 2500 volts . . . and for 2501 to 4600 volts . . . are catalog listed units in the Allen-Bradley line. Illustrated below is a limited variety of starters for squirrel cage, wound-rotor, and synchronous motors. Starters for manual or automatic operation are available. Starters for 600 volts or less are available in ratings up to 600 hp. High voltage starters are rated up to 1500 hp.

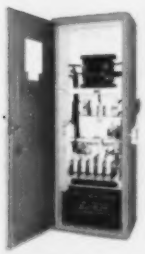
Write for a copy of the Allen-Bradley Handy Catalog in which all varieties of "big starters" are listed. It is also a handy buyer's guide on the latest developments in controls and accessories.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

In Canada
Allen-Bradley Canada Ltd., Galt, Ont.

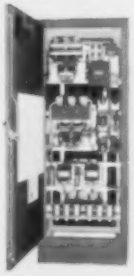
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A FEW OF THE BIG STARTERS IN THE ALLEN-BRADLEY LINE



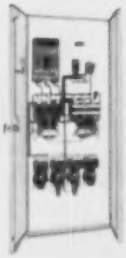
Bulletin 646 manual autotransformer type starter

Bulletin 740 automatic reduced voltage motor starter

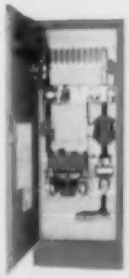


Bulletin 742 automatic starter—velvet smooth acceleration

Bulletin 746 automatic autotransformer type starter

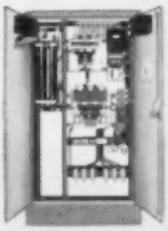


Bulletin 761 automatic wound-rotor motor starter

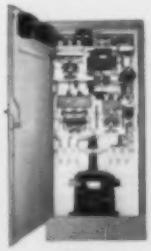


Bulletin 906 across-the-line synchronous motor starter

Bulletin 906 high voltage synchronous motor starter

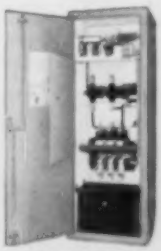


Bulletin 914 reduced voltage synchronous motor starter



Bulletin 922 low voltage synchronous motor starter

Bulletin 922 high voltage synchronous motor starter

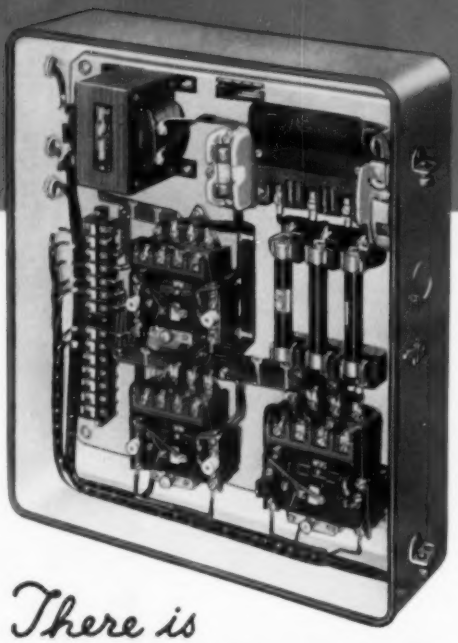


Bulletin 1109 high voltage across-the-line starter

Bulletin 1146 high voltage squirrel-cage motor starter

9-55-MR

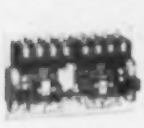
Oakes mixing machine for continuous mixing of raw materials in the rubber and chemical industries.



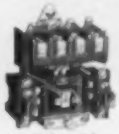
Close-up of Allen-Bradley automatic motor control panel.

The Sign of QUALITY MOTOR CONTROL

Service-tested Components for Automation Control Panels



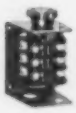
Reversing Switch



Solenoid Starter

Multispeed Starter

Solenoid Relay



Pilot Switch

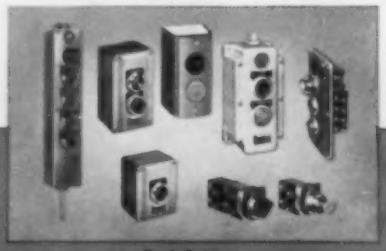
Drum Switch

Pneumatic Timer

Pressure Switch

Zero Speed Switch

Limit Switches



Push Buttons

There is SALES VALUE for YOU in the A-B TRADEMARK

Time has established the A-B trademark as the sign of Quality in motor controls. It is so recognized by the buyers of your motorized machines. So, why not standardize on Allen-Bradley controls.

Years and years of trouble free service in every conceivable industry has proved conclusively that A-B controls are a real sales asset to any machine. You just cannot beat Allen-Bradley controls for simplicity in design . . . your guarantee for reliable and consistent performance.

Whether you need a single starter or an all-inclusive special control panel, call in your nearest Allen-Bradley sales engineer. Let him recommend the components that will assure the most continuous output from your machines.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

9-53-MR

This could be you—"In the Land of No Distributors."

Imagine the chaos that would result if there were no distributors!

Conceivably, most of your day would be spent interviewing and sampling the wares of a constant stream of manufacturers salesmen. How much easier—and more time saving to rely on your distributor salesman to keep you abreast of the thousands of different products he handles.

In addition, "in the land of no distributors"—

- **you would have to place orders all over the country and wait for erratic deliveries**
- **you would be forced to carry a tremendous inventory (and insure it)**
- **your "over-the-counter" purchases would be major headaches**
- **your order department and accounts payable department would have to be increased a hundredfold**

That's why dependable electrical manufacturers advise you to always buy from—

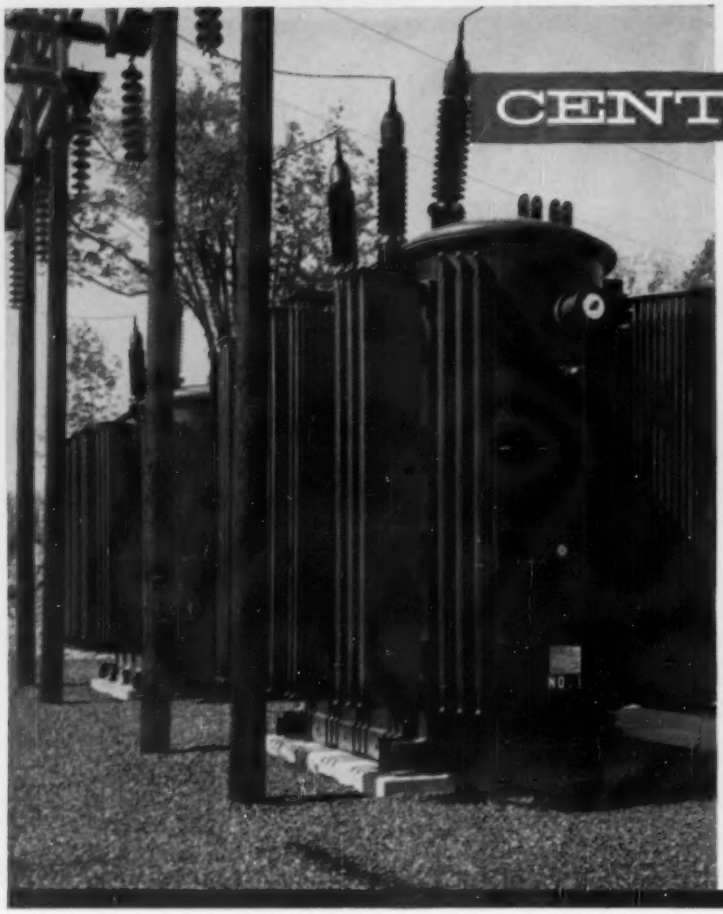
YOUR DISTRIBUTOR—THE BEST FRIEND YOUR BUSINESS CAN HAVE! He's the *one* source for *everything* electrical—and he's local.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • BRASS and COPPER TUBE • PLASTIC PIPE



CENTRAL

power transformers help speed construction of St. Lawrence power project

2 10,000 KVA, 3-phase 115 KV to 13.8 KV Central transformers now in service at Polley's Bay Substation, Massena, N. Y. Uhl, Hall & Rich, Boston, Mass., engineers for St. Lawrence Project.

Designed, manufactured and tested in Central's modern plant for the New York Power Authority, these Central transformers are furnishing power for the construction of the gigantic St. Lawrence Power Project.

No matter what your requirements may be, there's a precision-built Central transformer to fill them to your complete satisfaction. We welcome your inquiries.

a type for every need . . . from the smallest to the largest

DESIGNERS AND MANUFACTURERS OF TRANSFORMERS ONLY

CTC NEMA

Sales offices in principal cities
PINE BLUFF, ARKANSAS

Central

ANACONDA EXPANDS IN ALUMINUM

Reduction plant of the Anaconda Aluminum Company at Columbia Falls, Montana, is soon to give Anaconda control over its aluminum production from reduction of alumina . . . to ingot . . . to finished product.

A new reduction plant — a new modern rod mill — five separate aluminum fabricating mills — an engineering organization with years of experience in industry problems — *all* assure completely integrated service for users of the white metal!

Newest in the United States is Anaconda's modern aluminum rod-rolling mill at Great Falls, Montana. In addition to rod mill, the building houses the latest wire drawing and stranding equipment.

Anaconda's five aluminum wire and cable fabricating mills today have two new big brothers.

One is the imposing new plant shown above—Anaconda Aluminum Company's new reduction plant at Columbia Falls, Montana. It will provide Anaconda with its own major source of primary aluminum — 120,000,000 pounds of the white metal a year.

The second is Anaconda Wire & Cable Company's new aluminum rod-rolling mill at Great Falls, Montana (below). This mill is the most advanced in the country. It is completely automatic.

Today, Anaconda's five strategically located aluminum wire and cable mills . . . together with Anaconda's national *network of distributors* . . . make certain you get the aluminum wire and cable you want — *where* and *when* you want.

Quality products are a tradition with Anaconda. The most modern aluminum facilities in the country are backed by long years of experience with *many* metals . . . with *all* types of transmission and distribution wire and cable.

For all your aluminum wire and cable . . . for the highest quality aluminum products today . . . for engineering assistance at every stage . . . you can look with confidence to Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 60974

*Reg. U. S. Pat. Off.

ANACONDA®

Bare aluminum • ACSR • Neoline* weatherproof • Duroline* weatherproof • Braid weatherproof • Polyethylene line wire • Type K service drop • Type N-SD service drop

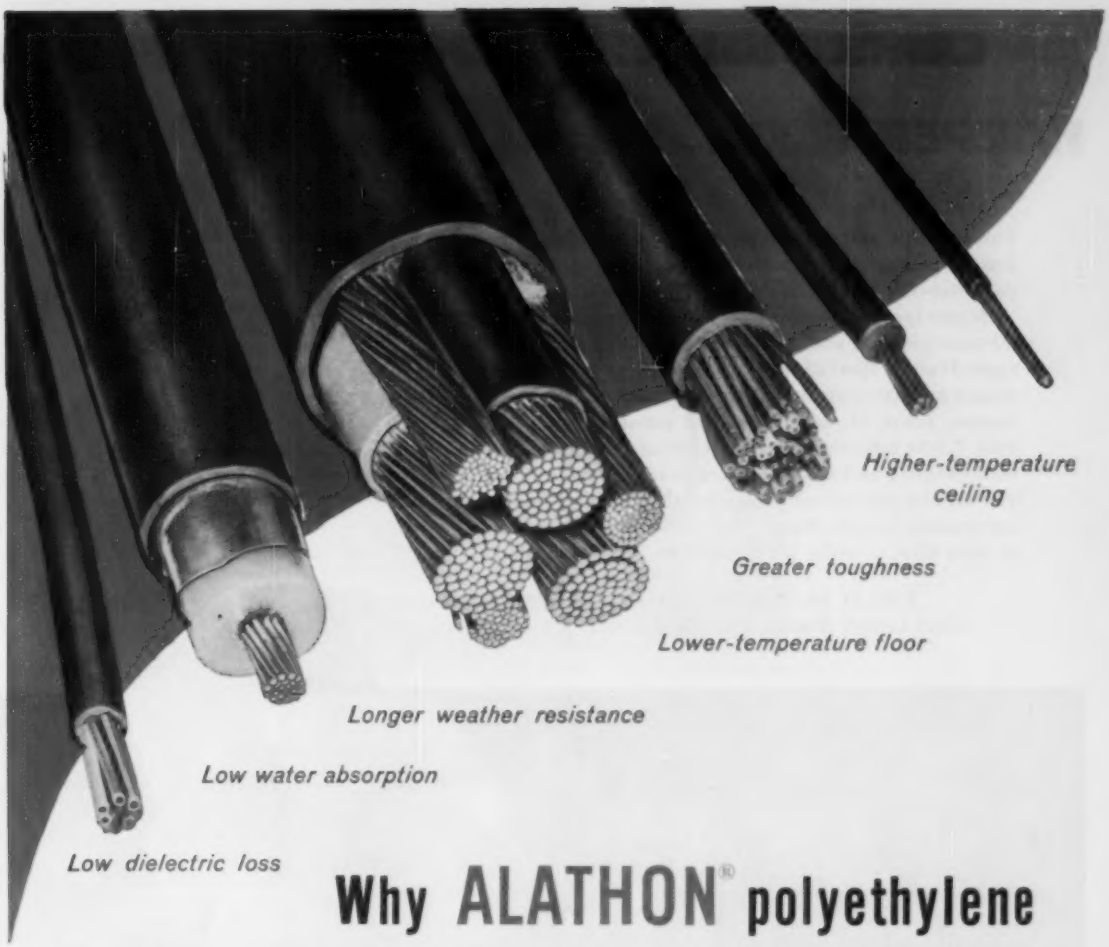
8 "BUFFALO" INDUCED DRAFT FANS =2,800,000 LBS/HR OF POWER-PRODUCING STEAM

The eight "Buffalo" Induced Draft Fans above serve the four reheat cycle steam generators of the 400,000-kw Wabash River Station of the Public Service Company of Indiana, Inc., above, right. It takes a lot of air to produce power — and the source of air must be as reliable as the fuel. This is why "Buffalo" is the choice for the punishing induced draft job in so many utility stations as well as in industrial power plants. Write for Bulletin 3750 and see why "Buffalo" Forced Draft, Induced Draft, Gas Recirculating and Primary Air Fans give the dependable air delivery your boilers need for top output!

"Buffalo"

BUFFALO FORGE COMPANY
212 MORTIMER ST. BUFFALO, NEW YORK
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



Why ALATHON® polyethylene is superior for insulation and jacketing

New properties of "Alathon" polyethylene resin make it superior for insulating and jacketing of aluminum or copper conductors.

The higher melting point of Du Pont "Alathon" permits higher temperature ratings. The low brittleness temperature and improved abrasion resistance of "Alathon" assure years of trouble-free service. Jacketing of Du Pont "Alathon" is pliable, lightweight, and tough.

For more information, clip the coupon.

There *is* a difference in polyethylenes—

specify **ALATHON**®
polyethylene resin

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department,
Room 3512 Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited,
P. O. Box 660, Montreal, Quebec.

Please send me information on Du Pont "Alathon" polyethylene resins. I am interested in evaluating these materials for

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Name_____ Position_____

Firm Name_____

Street Address_____

City_____ State_____

Type of Business_____

CORROSION... *Tough Utility Problem*

HARPER FASTENINGS... *Simple solution*

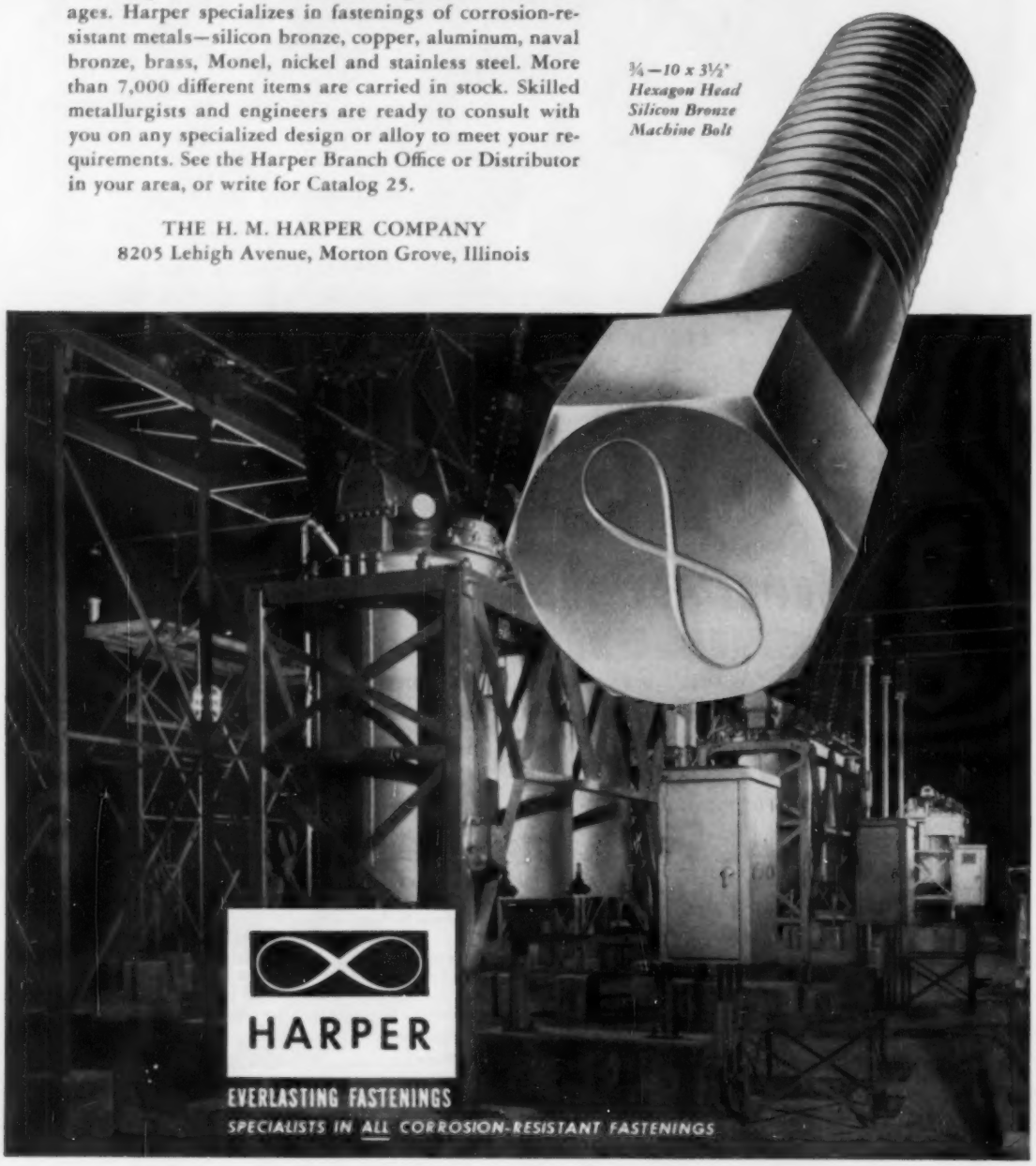
From turbine to transformer—substation to distribution line—all electrical equipment is subject to corrosion, the day-after-day menace to dependable electric service.

Harper fastenings protect equipment from costly breakdowns—provide added insurance against serious outages. Harper specializes in fastenings of corrosion-resistant metals—silicon bronze, copper, aluminum, naval bronze, brass, Monel, nickel and stainless steel. More than 7,000 different items are carried in stock. Skilled metallurgists and engineers are ready to consult with you on any specialized design or alloy to meet your requirements. See the Harper Branch Office or Distributor in your area, or write for Catalog 25.

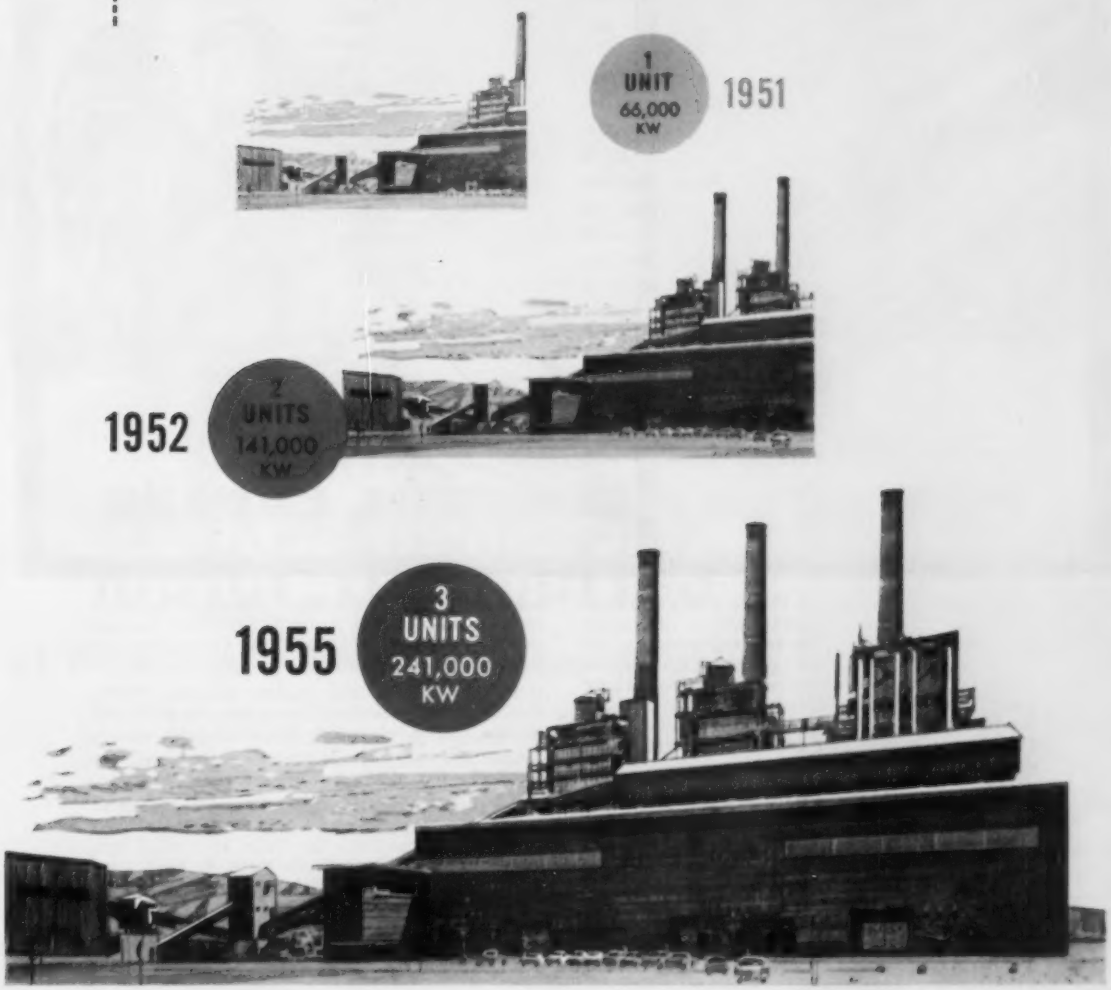
THE H. M. HARPER COMPANY
8205 Lehigh Avenue, Morton Grove, Illinois

BOLTS • NUTS • SCREWS
WASHERS • RIVETS • SPECIALS
SILICON BRONZE • COPPER • ALUMINUM
NAVAL BRONZE • BRASS • MONEL
NICKEL • ALL STAINLESS STEELS

¾—10 x 3½"
Hexagon Head
Silicon Bronze
Machine Bolt



As Gadsby Grows...So Grows Utah



THE GADSBY PLANT OF UTAH POWER & LIGHT COMPANY

Salt Lake City people look upon the expansion of the Gadsby Plant as a reliable gauge of their area's development. Bechtel, in cooperation with Utah Power & Light Engineers, designed and built it in three stages. Through planned growth, capacity was kept well ahead of demand. In operation the plant has proved economical and well suited to U. P. & L's requirements. Gadsby is another example of a power problem ideally solved by experience and organization.

BECHTEL

BUILDERS FOR INDUSTRY

BECHTEL CORPORATION

Los Angeles • SAN FRANCISCO • *New York*

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE

RUBBER and PLASTIC
POWER and CONTROL CABLES

When you need Rubber and Plastic Power and Control Cables . . . look to General Cable . . . for every type, for every use . . . for fast deliveries . . . for UNMATCHED QUALITY! These General Cable products have earned an enviable reputation among users for transmission, distribution and control . . . for direct earth burial . . . for duct and conduit . . . for submarine use . . . and for self-supporting aerial applications.

As the biggest producer, General Cable makes the widest range of types. To mention a few: network, high voltage, supervisory and station control, series street lighting, pole and bracket, self-supporting aerial, and generator lead cables.

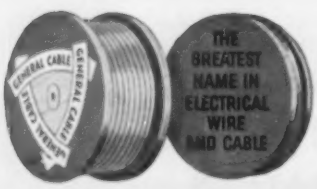
Constructions consist of copper and aluminum conductors. Insulations: GENCASEAL (Thermoplastic Vinyl), polyethylene, THERMAX W (moisture and heat resistant), AQUASEAL (heat and moisture resistant—low SIC), GENCORONE (ozone-resistant oil base), BUTARONE (ozone-resistant butyl base).

Outer coverings include rubber, neoprene, GENCASEAL, lead, reinforced neoprene over lead, and textiles (cotton, glass, asbestos, sisal, jute, rayon).

Armor finishes include steel, bronze, aluminum interlock; flat steel, and galvanized wire armor.

These popular and versatile products are made to meet *every* operating condition. Where standard types are not suitable for your particular use, special constructions will be made to meet your exact needs. Get the complete facts before you buy. Let our engineers help to solve your wire and cable problems. And, remember, that General Cable is the *only* manufacturer who can supply *all* your wire and cable needs!

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
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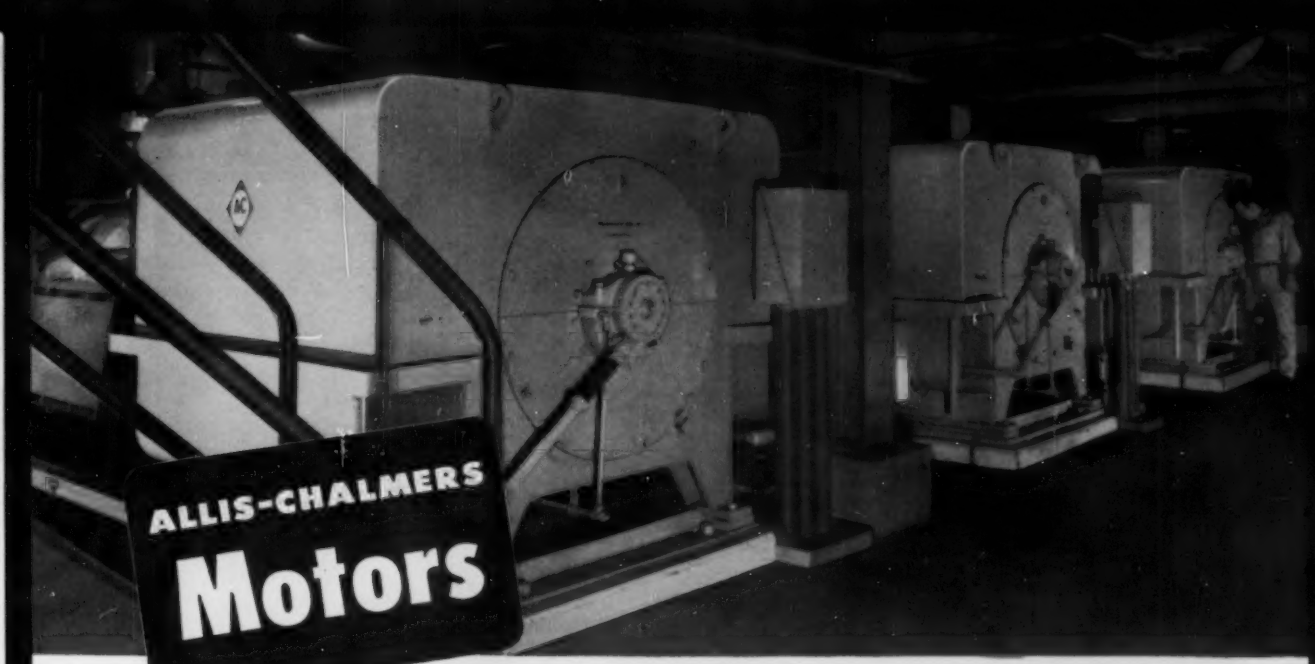
SALES OFFICES: Atlanta • Baltimore • Boston • Buffalo Chicago • Cincinnati • Cleveland • Dallas • Dayton • Denver Detroit • Erie (Pa.) • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Lincoln (Neb.) • Los Angeles Memphis • Milwaukee • Minneapolis • New Haven • New Orleans • Newark (N. J.) • New York • Philadelphia Pittsburgh • Portland (Ore.) • Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) • St. Louis • San Francisco Seattle • Springfield (Ill.) • Syracuse • Tampa • Tulsa Washington (D. C.)



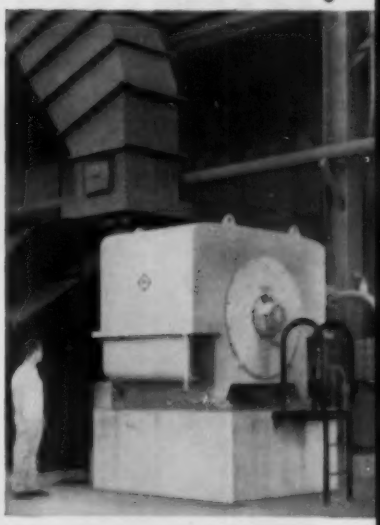
Driving ALL Major Auxiliaries

at Houston's New Webster Station

Weather-protected Allis-Chalmers motors are used throughout the modern outdoor Webster Station of Houston Lighting and Power Company. They provide low-cost outdoor installation plus dependable operation under all weather conditions.

These motors are but a few of the complete line of motors Allis-Chalmers builds for power plant service. Check with the A-C office in your district or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4832

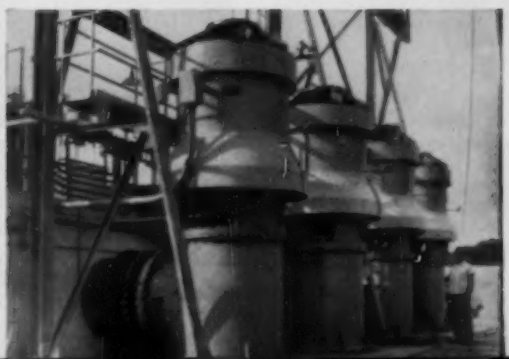
Three of the six 1750-hp, 3575-rpm, 2300-volt Allis-Chalmers two-pole motors providing unusually quiet drives for boiler feed pumps.



Two 350-hp, 1170-rpm, 440-volt Allis-Chalmers condensate pump motors.

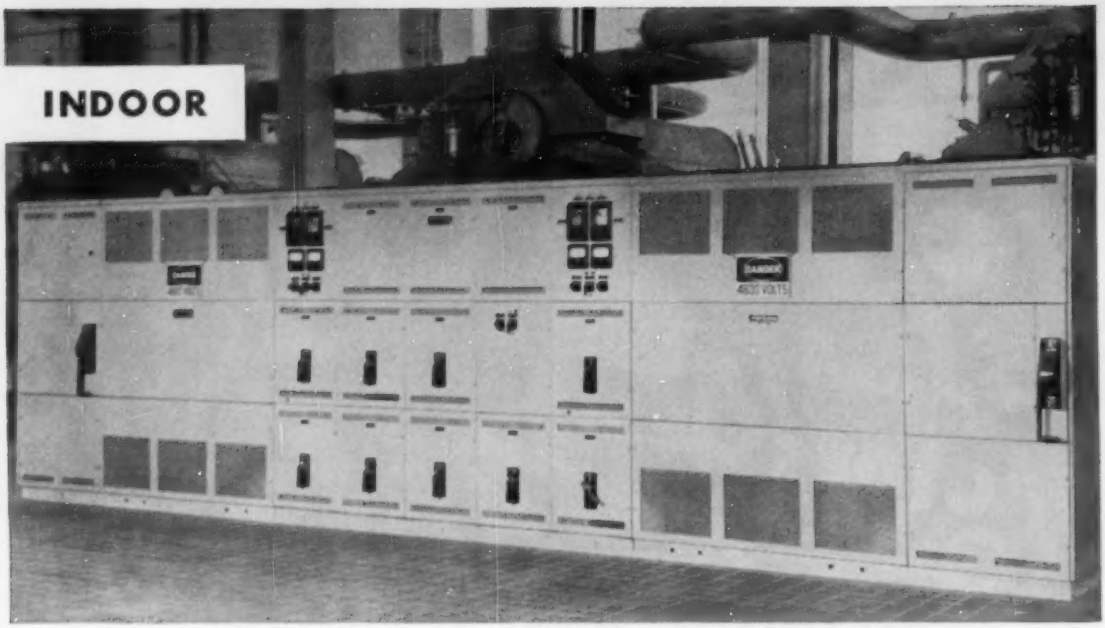
One of four 1250-hp, 880-rpm, 2300-volt cage motors driving forced-draft fans.

ALLIS-CHALMERS



Four 800-hp, 514-rpm, 2300-volt vertical Allis-Chalmers circulating water pump motors.

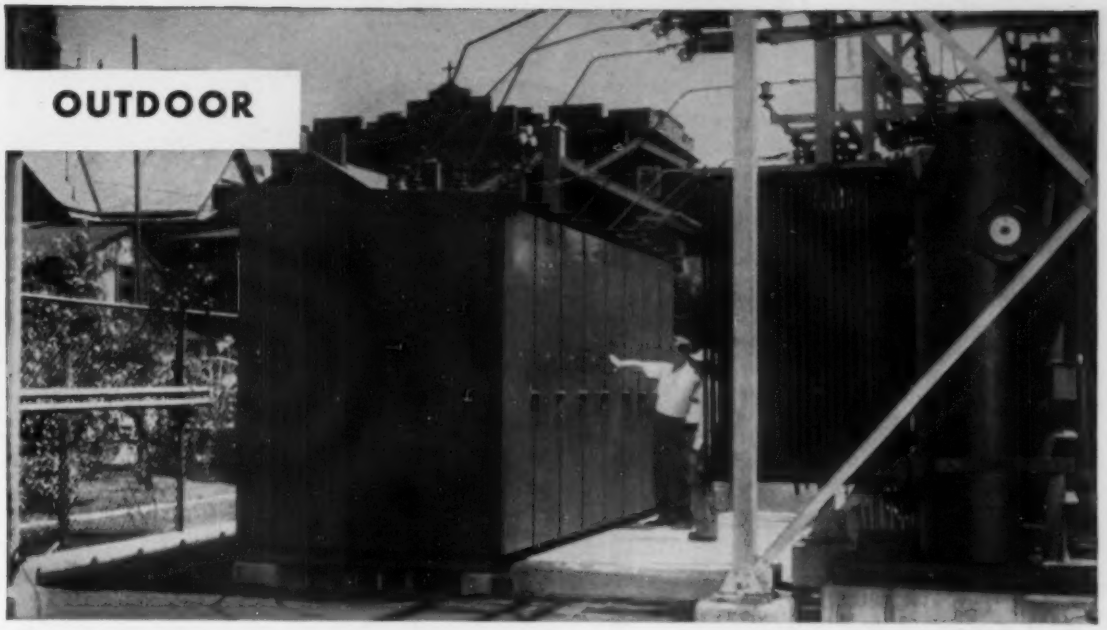
Engineers and Constructors — Ebasco Services Incorporated



I-T-E, SINGLE SOURCE OF SUPPLY

Primary Section: Maximum protection on the primary side is assured with I-T-E Power Air Circuit Breakers. As an alternate to circuit breakers, roof bushings, throats, terminal chambers, oil cutouts, liquid disconnect switches or air interrupter switches may be furnished.

Transformer Section: I-T-E can supply any type of transformer required for a particular installation. It can be either liquid filled, nitrogen sealed, or dry type. All transformers match and line up with the primary and secondary sections to create one complete unit.



FOR COMPLETE UNIT SUBSTATIONS

Secondary Section: The secondary section consists of I-T-E switchgear. Completely interchangeable, horizontal drawout air circuit breakers are housed in a sturdy structure with completely isolated compartments, large rigidly braced bus, and a superior exterior finish.

You can buy a unit substation either of two ways: a piece at a time (the expensive way), or all at once (the economical way). I-T-E can sell you the individual elements, but recommends that substations be purchased complete, and from a single source of supply.

There are good, practical reasons for this. I-T-E's engineering assistance in over-all planning, floor layout, and choice of elements is more valuable to you when it covers the complete substation. Units are packaged and shipped ready to install without delay or complications.

There are further advantages in knowing that one dependable company stands behind your complete installation, and that all parts are designed to function as a unit.

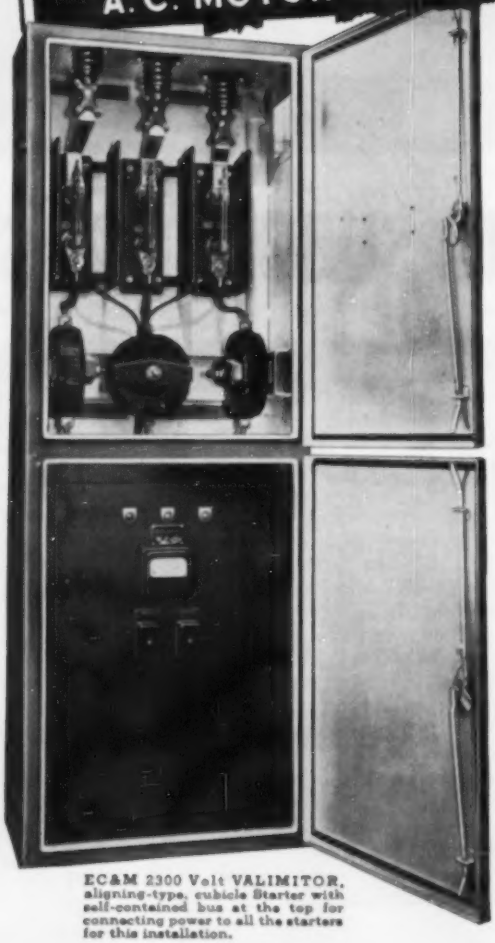
I-T-E Primary and Secondary Unit Substations can be supplied for any application: indoor and outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pennsylvania.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

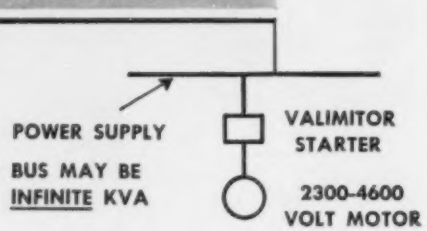
RESTART in a matter of seconds -- no parts to replace --PAYS for itself, if there's ONE FAULT

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND, OHIO U.S.A.

VALIMITOR
TRADE MARK
A.C. MOTOR STARTER



EC&M 2300 Volt VALIMITOR, aligning-type, cubicle Starter with self-contained bus at the top for connecting power to all the starters for this installation.



Stop and consider the reduction in down-time an EC&M VALIMITOR Starter will *save* after a fault. Damage in the motor circuit will be *minimized* by the VALIMITOR coils—the circuit will be cleared *quickly* and *safely* by the well-known Type ZHS magnetic contactor. When the cause of the fault has been remedied, the EC&M VALIMITOR starter will get production rolling again in a matter of seconds.

And EC&M VALIMITOR Starters are easy to apply on a system of *any* capacity. No need to figure "short" capabilities of existing bus including estimate for future growth. These starters may be applied to a bus of infinite KVA . . . fault currents will be limited to a maximum of 25,000 KVA (steady state current) and the EC&M Type ZHS Contactor of 50,000 KVA interrupting capacity clears the circuit quickly.

Remember that EC&M VALIMITOR Starters save time . . . in application . . . in installation . . . in restarting after a fault.

Write for **T9-117**

Reprint Bulletin

THE ELECTRIC CONTROLLER & MFG. CO.
4498 LEE ROAD ★ CLEVELAND 28, OHIO

from Iowa-Illinois Gas and Electric:

"Penta-treated poles are clean, easy to handle, last longer!"

Iowa-Illinois Gas and Electric Co. first used Penta-treated poles in 1941 and Penta-treated crossarms in 1944. Today, nearly 100% of the pine, fir and western red cedar poles installed by the company are Penta-treated. The company also uses Penta-treated wood for substation construction and platforms.

An Iowa-Illinois official reports: "Penta preserves poles much longer, keeps wood from rotting away and protects it from fungi in the air. The average life of an untreated pole is 15 to 20 years. The Penta treatment should extend that life to about 40 years or more." Veteran Iowa-Illinois lineman says: "Penta-treated poles are much cleaner to work with and we don't get the skin irritations we used to before we began using poles treated with Penta."

PENTA-TREATED WOOD IS CLEAN because Penta stays locked in wood cells, won't bleed or leach out, gives wood long-lasting protection against decay, and against termites and other wood-destroying insects as well. Clean, dry Penta-preserved wood won't "burn" hands or stain clothing, makes line installation and maintenance easier.

PENTA PROTECTS POLES, CROSSARMS, TRANSFORMER PLATFORMS, BRACES, CONTROL BOXES AND PLANKING. Mail coupon for list of 85 treating plants that will apply Penta for you . . . and for FREE Penta "Poles and Crossarms" booklet.

Where creative chemistry works wonders for you

Visit Monsanto's exhibit at Walt Disney's

Disneyland

Anaheim, California

MONSANTO

CHEMICALS – PLASTICS

FREE BOOKLET

Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Box 478-9-8
St. Louis 1, Missouri

Please send me ☐ "Poles and Crossarms" booklet
☐ List of 85 Penta-treating plants

Name .....

Address .....

City ..... *State* .....

Baltimore G & E Builds New Plant, Erects 9½-Mi Line

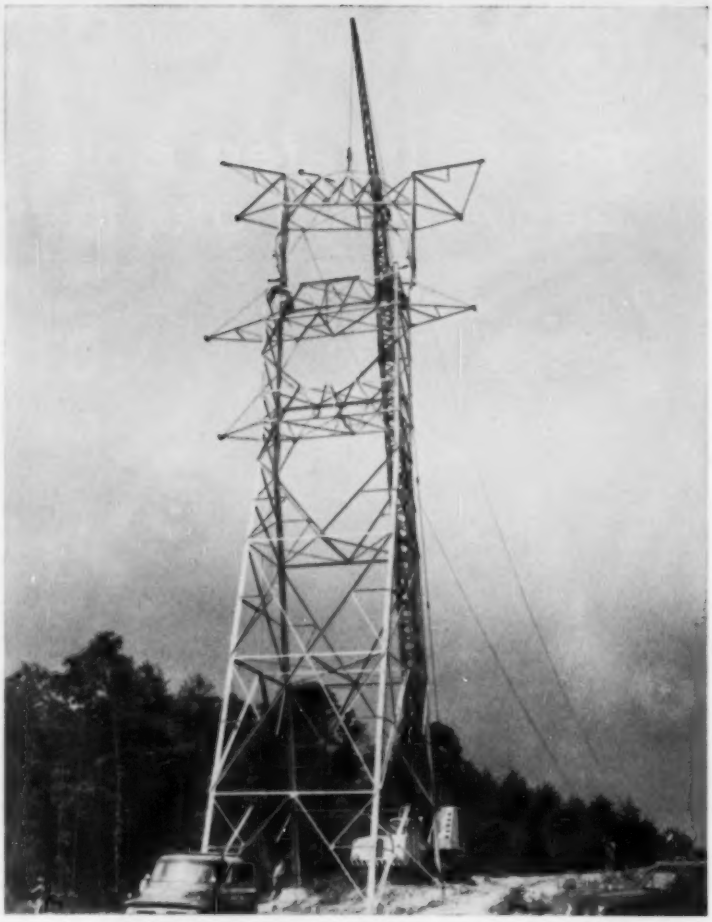
Triple-circuit steel towers connect new steam electric generating station with 110,000-volt system

With customer demands for electric power constantly increasing, Baltimore Gas and Electric Company (formerly Consolidated Gas Electric Light and Power Company of Baltimore) has a number of important projects under way. Included is the construction of Herbert A. Wagner steam electric generating station at Hawkins Point near the Baltimore city limits. The new plant will accommodate eight generator units. The first, a 125,000-kw unit, will be placed in service early in 1956.

9½-MILE LINE . . . Distribution of the new station's output is to be through an existing switching structure located 9½ miles away. Triple-circuit galvanized steel towers, designed and fabricated by Bethlehem, will carry 110,000-volt circuits connecting the two points. Initially one circuit consisting of 1,033,500 cm A.C.S.R. power conductors and a ⅜-in. E. H. S. Copperweld overhead ground wire will be installed. The remaining two circuits will be added at a later date.

It is interesting to note that the capacity of the new circuit, approximately 250,000 kva, is more than the Baltimore Company's total electric load just twenty years ago!

FABRICATED AT LEETSDALE, PA. . . . The 75 towers used for the line from the Herbert A. Wagner Station were detailed, fabricated, and galvanized at our fabricating works at Leetsdale, Pa., near Pittsburgh. Approximately 1100 tons of steel were used for the towers, which average 100 ft in height.



Men of Baltimore Gas & Electric Company's overhead division are shown erecting a top frame which had been pre-assembled on the ground. The line's 75 steel towers average 100 ft in height.

If you are in the market for transmission towers and switching structures, we suggest that you keep Bethlehem in mind. Our shops at Leetsdale, and at South San Francisco, Calif., and Seattle, Wash., are well equipped to handle all your requirements, small or large, simple or complex.

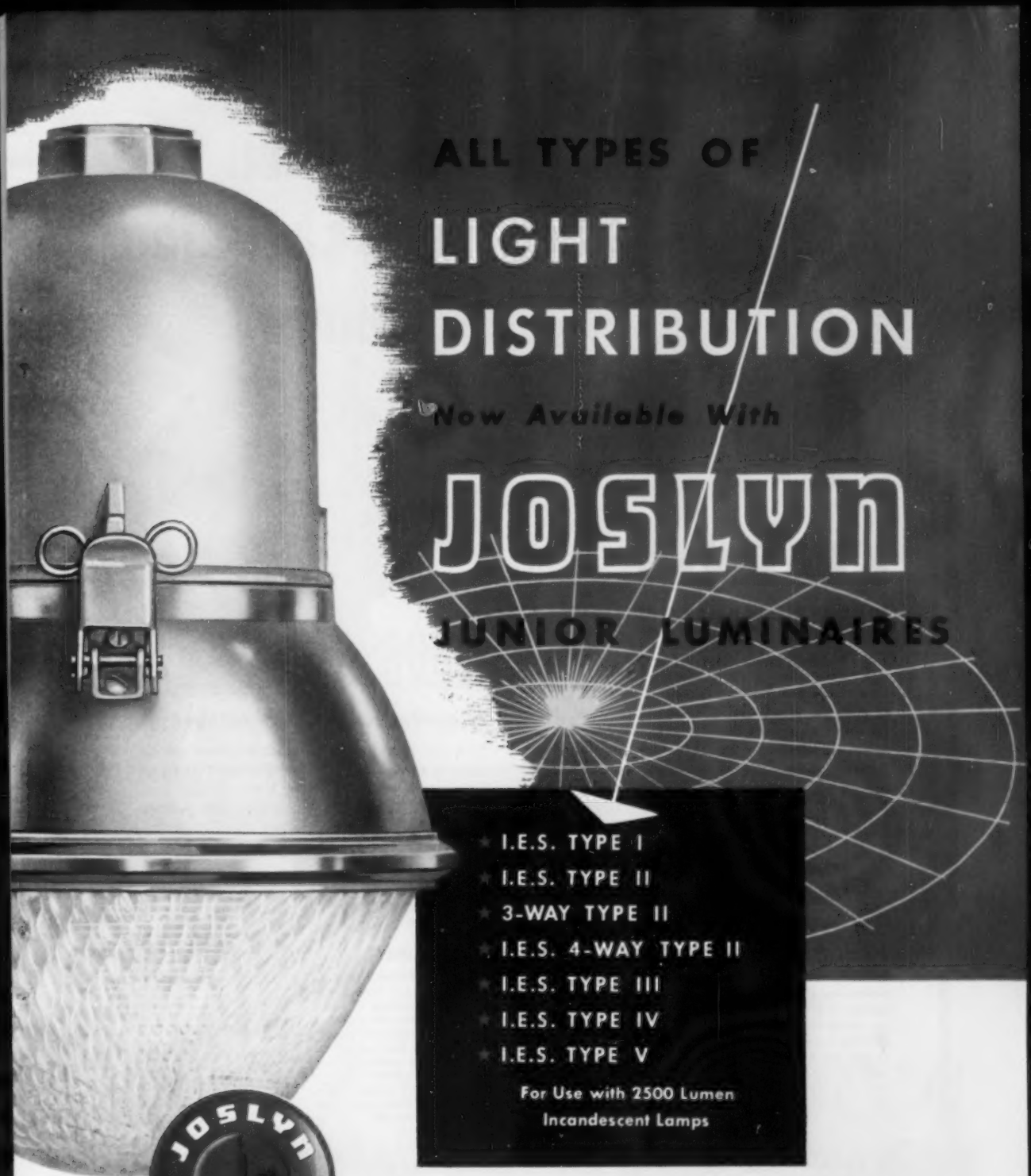
For additional information, please get in touch with the Bethlehem sales office most convenient to you.

The new transmission line extends from the generating station at Hawkins Pt. 9½ miles to Pumphrey Switching Station on the 110-kv system.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL



JOSLYN MFG. and SUPPLY CO.
155 North Wacker Drive
CHICAGO 6, ILL.

Only Joslyn Junior Luminaires are Available in all these Light Distributions

The link between you and satisfied customers

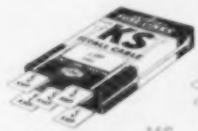
KEARNEY
FUSE LINKS

To restore service faster

Linemen work faster when all they need to do is pull the handy KEARNEY Fuse-Pak tab to unpack a fuse link. It's by far the most efficient method of packing . . . particularly when men are wearing heavy gloves and working in bad weather. As an added help, every KEARNEY Fuse-Pak is brightly color-coded to save time and prevent mistakes.

To prevent unnecessary outages

You can keep even the most troublesome circuits in operation safely with these "coordination-engineered" KEARNEY Fuse Links. They are available in six types to suit your particular requirements:

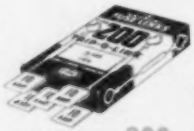


KEARNEY Type KS

Specially designed to protect and still keep outages at a minimum on circuits subject to switching and lightning surges. KS overload capacity is identical with Type 200, but surge capacity is twice as great.

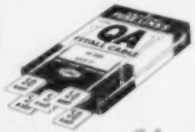
KEARNEY Type X

A specialist at keeping transformers in service during heavy overloads and surges... yet clears the fault before damage range is reached. Opens 230% of rated current within five minutes.



KEARNEY Type 200

Specially made for troublesome circuits that are subject to long-time overloads and surges. Overloads up to 150% can be carried indefinitely without damage to fuse link or cutout.



KEARNEY Type QA

The QA link is designed to open at a lower percentage of rated current, and therefore will melt more rapidly than fuse links of the same ampere rating which have been designed to open 230% of rated load within five minutes.

KEARNEY Type K

EEI-NEMA standard fast fuse link.

KEARNEY Type T

EEI-NEMA standard slow fuse link.

JRK-283

For Better Construction...Safer Maintenance

Specify **KEARNEY PRODUCTS**

JAMES R. KEARNEY CORPORATION ST. LOUIS MO GUELPH, ONT

The Mark of Quality

JAMES R. KEARNEY CORPORATION • 4234-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

Overall view of substation showing socket-installed Lincoln ammeters and voltmeters on two circuits.

LICK LOADING PROBLEMS WITH LINCOLN METERS

flexible, fool-proof, low cost method gives complete substation measurement

Now, you can get simplified measurement for system operation — at your substations —by means of a permanent installation of meter sockets and the use of various types of Lincoln "Indicating Meters with a Memory." You can secure detailed knowledge of circuit operation by "plugging in" Lincoln Graphics to obtain time of occurrence and duration of system conditions.

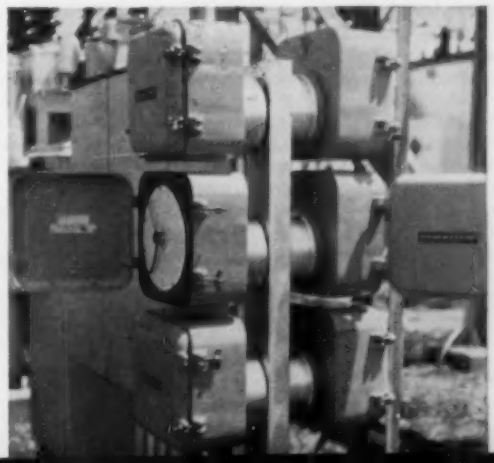
Socket type meters to measure amperes, volts, vars, or kw can be installed in any of the sockets. Any lineman can make the installation, since no wiring changes are necessary. The socket makes the correct connection for the meter "plugged in."

Write today for full information on Lincoln Meters and Simplified Measurement for System Operation.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

This permanent installation of ammeters shows loading and balance on phases.

Reactive and Kilowatt Lincoln Demand Meters in paired sockets correlate kvar and kw data.



SM55-4

Kaiser Aluminum "Triplex" Cable covered with BAKELITE Polyethylene is sold by **Kaiser Aluminum & Chemical Sales, Inc.,** Chicago 11, Ill.

There's a big saving here

The service drops on this street in Roanoke, Va. illustrate important economies possible for utilities who take advantage of the light weight construction of Kaiser Aluminum "Triplex" Cable covered with BAKELITE Brand Polyethylene. Notice their large spans, compared to the short spans and extra pole required for the telephone lines.

Today, utility *and* telephone companies are cutting their installation costs with the weight saving advantages of cable insulated with Polyethylene.

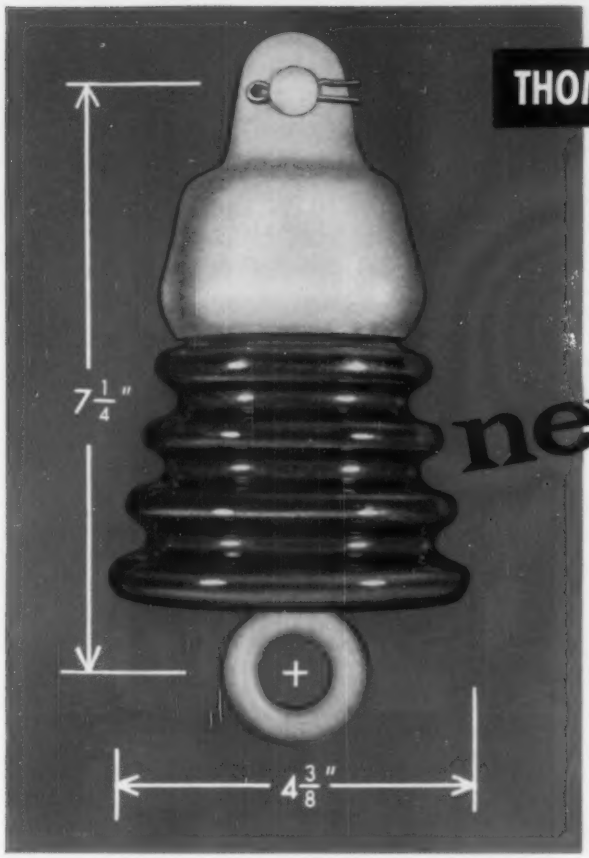
This service drop is a real weight-saving, pole-saving, money-saving combination. The manufacturer states that it can save as much as 25 per cent over conventional open wire service.

BAKELITE Polyethylene is the lightest commercial plastic. It also has high tensile, impact, and flexural strengths. It pulls and strips easily, yet won't festoon or rot. The BAKELITE Polyethylene compound used here demonstrates outstanding resistance to moisture, sunlight, weathering, and aging. It withstands acids, alkalies, chemicals. Dielectric properties are excellent.

Installation economy and long service life make BAKELITE Polyethylene worthy of your consideration. To learn more about it, write Dept. KP-53.

BAKELITE BRAND
Polyethylene Plastic

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario
The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC



THOMAS *Best by line test*

new design

1 for 2

RUGGED-TYPE GROOVED STRAIN INSULATOR

This single unit does the work of *two* 6" or one 10" conventional disc-type unit and is used for dead-ending voltages up to and including 12 Kv. Its superior mechanical and electrical characteristics effect a very substantial reduction in dead-ending cost. Note the smooth lines formed by the outer edges of the corrugations and forged steel cap—no porcelain projections to receive the brunt of rough handling. If dropped, impact is distributed uniformly over porcelain and cap . . . reduces danger of breaking.

Thousands of units are giving satisfactory performance. Reports indicate that the new Thomas design is superior to any previous dead-ending unit.

Specify Thomas Catalog No. 1315 Rugged-Type Grooved Strain Insulators with full confidence that their quality and value cannot be surpassed.

Packed 12 per carton in Thomas "PACKT-TO-STACK" modern cartons. Write for prices and sample today.

Engineering Characteristics

Flashover—Dry-65 Kv., Wet-35 Kv., M & E Strength—10,000 Lbs., Leakage Distance—7½ Inches.

The R. Thomas and Sons Co.

1873 THOMAS INSULATORS our 82nd year RELIABILITY 1955

LISBON, OHIO

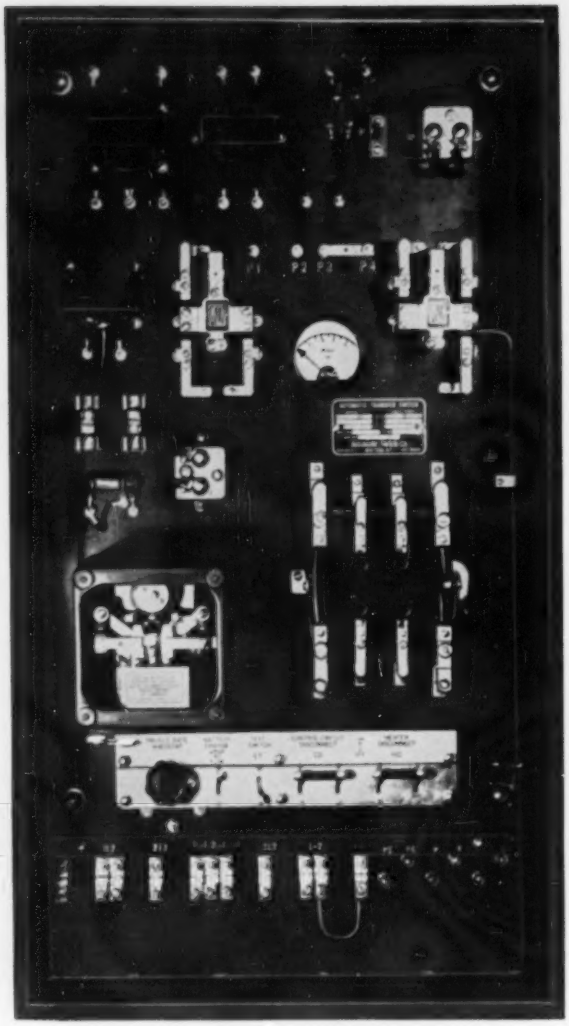
NEW YORK CHICAGO

Sales Representatives: **C. G. Anderson,** *Chicago* **• E. B. Anderson Co.,** *Detroit* **• Ken H. Best,** *Seattle* **• Nellis B. Bronner, Jr.,** *Syracuse* **• R. E. Cunningham & Son,** *Los Angeles* **• W. H. Eddy Electric Products, Inc.,** *Phoenix* **• Electrical Distributors Co.,** *Philadelphia* **• Engineer Sales Co., St. Petersburg • Hamilton Associates,** *Denver* **• Geo. E. Honn Co.,** *San Francisco* **• Hugo Sales Co.,** *Minneapolis* **• J. E. Johansen,** *Lincoln* **• J. P. Lane Co.,** *St. Louis* **• J. O. Mann,** *Pittsburgh* **• Osgood & Associates,** *Atlanta* **• John G. Pettijohn Co.,** *Knoxville* **• J. F. Schaefer & Co.,** *Kansas City* **R. J. Sullivan Co.,** *Boston* **• Walter E. Thompson Co.,** *Birmingham* **• Triangle Electric Supply Co.,** *El Paso* **• United Electric Supply Co.,** *Salt Lake City* **J. H. Warrington,** *Lexington* **• Williamson Sales Co.,** *Shreveport, Amarillo, Beaumont, Corpus Christi, Dallas, Houston, Jackson, New Orleans, Pine Bluff, San Antonio* **• Representatives in other principal cities**

K&M
Ebonized Asbestos

- **resists vibration**
- **resists shock**
- **resists temperature changes**

Specify this ideal insulating material for your mounting panels



This Automatic Transfer Switch, manufactured by Automatic Switch Co., Orange, N. J. is mounted on K&M Ebonized Asbestos.

Made of asbestos fiber and portland cement, molded under pressure into sheet form and impregnated with an asphaltic compound, K&M Ebonized Asbestos is the perfect insulating material. It has exceptionally high dielectric strength. Its high mechanical strength makes components stay put, provides stubborn resistance to vibration, shock, temperature changes. Ebonized Asbestos is light in weight, uniform in density, easy to cut and drill.

You'll find it's ideal wherever you need strong, shatter-proof insulating material for mounting electrical apparatus—on switchboards, bus bar supports, cabinets, compartment linings, bench boards, testing tables.

Other K&M Asbestos products include Monobestos (asbestos fiber and portland cement, highly resistant to arc, and fire), asbestos cloth, tapes and tubing for electrical equipment.

Send for data. We'll gladly send complete information on Ebonized Asbestos and other outstanding K&M insulating materials. Write for details.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

In Canada: Atlas Asbestos Company, Limited; Montreal, Toronto, Winnipeg and Vancouver

SELLS 100 AMP SERVICE—

This "spread" works hard at promoting AW for both the modernization and new home markets. Impresses contractor with importance of continually selling AW on all fronts—and of cooperating with local AW drives.

METER MOUNTINGS FOR 100 AMP AND LARGER SERVICES—

Booklet describes Murray's full line of 100 Amp equipment including the most complete line of Meter Mounting equipment available for residential and light commercial installations.

HELPFUL HOME WIRING CHART—

This valuable check chart worked out in collaboration with leading contractors and AW experts helps contractors plan and install more adequately wired home electrical systems.

More ACTION on the "Adequate Wiring" Front!

THE three "spreads" you see here are from Murray's new 12-page 100 Amp Booklet. An important element in Murray's national 100 Amp Campaign, this booklet is designed to promote 100 Amp Service to electrical contractors in your area – and through them – to your homeowner-customers.

Copies are available to you absolutely *free* to supplement your own Adequate Wiring drives. Informative and helpful, you'll want to consider the booklet's use by contractors, architects, and builders in your area.

Let us know what your requirements are and we will fill them. No obligation whatever! Simply write Murray Manufacturing Corp., Dept. EW-3, 1250 Atlantic Ave., Brooklyn 16, N. Y.

"Quality doesn't cost . . . it pays!"

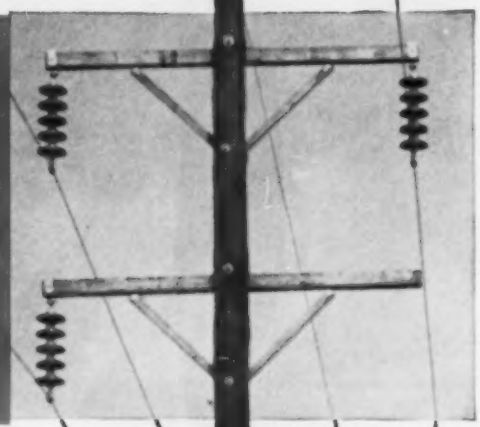
Murray

Safety Switches • Service Entrance •
Fuse Panels • Meter Mountings • Load Centers
Magnetic-Hydraulic Circuit Breakers

IN CANADA: MURRAY ELEC. MFG. CORP. (CANADA) LTD. TORONTO, ONTARIO

CREOSOTE

STILL
THE MOST EFFECTIVE LOW COST WOOD PRESERVATIVE



For over 50 years creosote has been, and still is, the most effective low cost chemical for prolonging the service life of poles, conduit and construction woods. And longer service life is the first and most important reason why you invest money in treated woods.

However, creosote must be applied properly for maximum results. Application is a job for an experienced treater—ONE WHO HAS A PROVEN SERVICE RECORD.

The American Creosoting Company, backed by over fifty years experience in wood preservation, has an enviable record. Amcreco creosoted materials have undergone the only conclusive test—*on the job* . . . long, long years of service with lasting strength throughout the life of the wood, and high resistance to fungi, borers, insects and natural enemies of wood.

When you put wood products to work you want longer service life and appreciable money savings through reduced repair and maintenance work. You can get it by taking advantage of Amcreco's fifty years experience. *We welcome the opportunity to help the buyer.* Amcreco's 23 plants and 12 sales offices are strategically located to give you the kind of service you require, wherever you may be.

AMERICAN CREOSOTING COMPANY

Shreveport Creosoting Company
Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

AMRECO
LOWRY PROCESS
CREOSOTED WOOD

Georgia Forest Products Company
Gulf States Creosoting Company
Georgia Creosoting Company
Bottle River Company

LOUISVILLE 2, KENTUCKY
12 FIELD SALES OFFICES TO SERVE YOU

MOTOROLA MICROWAVE

THE PATH

to improved operations

ECONOMICAL . . . the most economical type of multi-channel communication.

EASY TO EXPAND . . . channels can be inexpensively added.

WEATHERPROOF . . . the most reliable in snow, ice, rain, and high winds.

VERSATILE . . . spans rivers, swamps, mountains, and city streets with ease and is virtually unlimited in length.

PRIVATE . . . owner has complete control over communications at all times, and narrow beam assures private communication.

The dynamic power utility industry is increasing the emphasis on automation, data transmission, and centralized control to obtain better protection of personnel and property, better service, and more efficient operation—and microwave is providing the necessary communications. Motorola microwave systems are transmitting intelligence via telephone, telegraph, teletypewriter, telemeter, supervisory control, facsimile, television and many other devices.

Thousands of miles of Motorola microwave systems have been working dependably over the years in the power utility industry. This acceptance and experience means engineering and production "know how"—equipment which performs better, lasts longer, and costs less to maintain. These extra dividends repeatedly appear in operational records of Motorola microwave users.

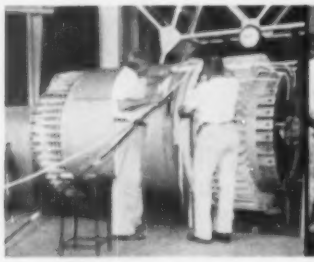
Partial list of systems operating in the power utility industry

Bonneville Power Administration
Brazos Electric Power Co-op.
Central Illinois Public Service Co.
Cleveland Electric Illuminating Co.
Dayton Power and Light Co.
East Kentucky RECC*
Idaho Power Co.*
Illinois Power Co.
Kansas Power and Light Co.*
Kentucky Utilities Co.
Middle South Utilities Co.
Modesto Irrigation District
Northern Indiana Public Service Co.*
North West Electric Power Coop.
Ohio Power Co.
Pacific Power and Light Co.
Puerto Rico Water Resources Authority
San Antonio Public Service Board
Southern California Edison Co.
Southern Counties Gas Co.
Texas Electric Service Co.
*Under Construction

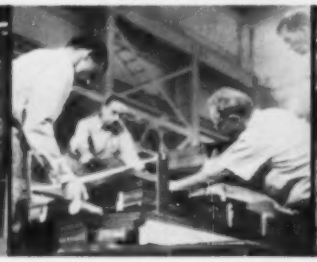
THE COMPLETE SUPPLIER OF RADIO COMMUNICATIONS SYSTEMS

MOTOROLA

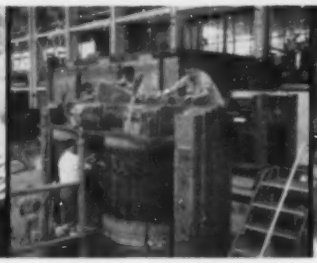
Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Illinois



Coils are designed by experts and wound by craftsmen to provide windings that withstand surges and overloads of actual service.



Core steel is stacked carefully with sufficient oil ducts to eliminate hot spots.



Core laminations for upper header are installed after coils are mounted over core legs.

Moisture is removed from core-and-coil units by dehydration—without impairing insulation life.

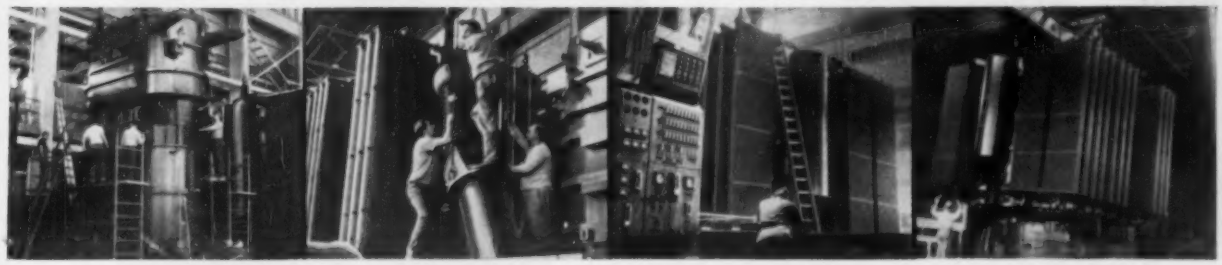
Ask them, any one of them, and they'll
all tell you the same thing. Stars don't win every game;
it takes real team work to do a winning
job . . . consistently.

. . CAN'T BE WRONG!

That's why Moloney emphasizes teamwork. Every step of
the way, from planning and designing to fabrication and testing,
Moloney's people work as a team. It's the best way to
produce dependable transformers that do a winning job . . .
consistently . . . for your utility system.

M658-56

Specify Moloney . . . Get Dependability at its Best . . . All Along the Line



Core-and-coil units are quickly sealed in tanks, while still warm from dehydration process, to prevent absorption of moisture.

Bushings, radiators, gauges and accessories are installed before transformers are tested, assuring proper operation of transformers as complete units.

Tests to assure dependable performance and proper operation, according to your specified requirements, are made by competent transformer engineers.

Complete transformers, ready for delivery, are well designed, skillfully fabricated and thoroughly tested, assuring long life and dependable performance.

MOLONEY ELECTRIC COMPANY

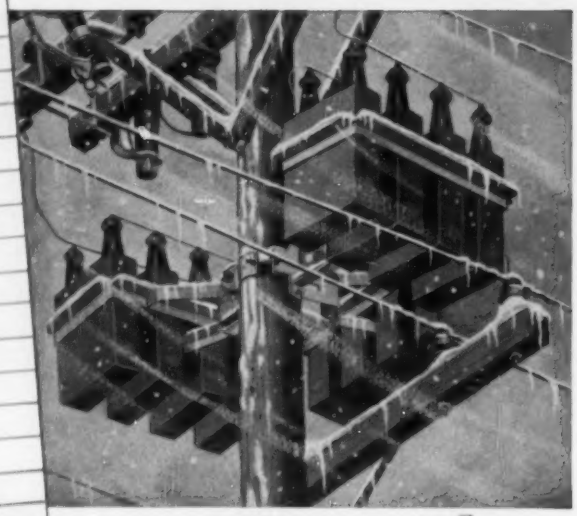
Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers Subway Transformers • Industrial Dry Type Transformers • Capacitors Magnetic Components For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Designed and built to specifications you might have written...

Power Capacitor Specifications

1. Corrosion protection – even though case finish is scratched.
2. Solder-sealed porcelain bushings.
3. Reliable performance at low ambient temperature.
4. Suitable for vertical or horizontal mounting.
5. Low losses.
6. Low temperature rise.
7. Stability under all operating conditions.
8. Terminal connectors for either copper or aluminum.



SANGAMO POWER CAPACITORS

Perhaps *you* were one of the many utility men Sangamo engineers talked to before starting to build "the power engineer's capacitor." In these talks we found out you wanted not only a capacitor that will release system capacity, raise system voltage and reduce system losses – but one that will do these things under all operating conditions.

The reason for the Sangamo Capacitor's reliable operation in low surrounding temperatures is Sangamo Diaclor, the high-strength, low-loss liquid dielectric which completely fills the capacitor. This characteristic permits switching of capacitor banks even after long periods of de-energization at low ambient temperatures.

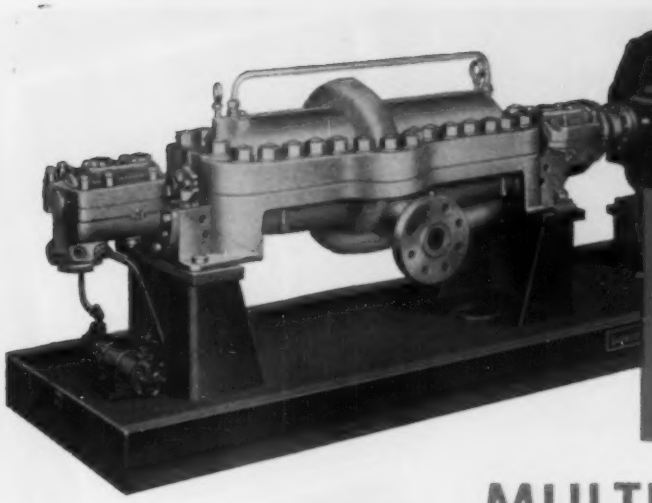
So no matter what winter brings—snow, ice, freezing rain—even 40 degrees below zero, Diaclor enables Sangamo Capacitors to go right on doing their jobs just as though it were a mild spring day.

For more details, write today for Bulletin 1120.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

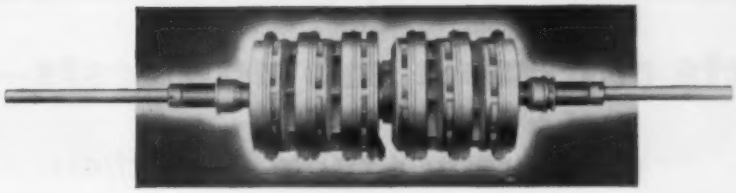
PCS5-5



Ingersoll-Rand

CNTA

MULTI-STAGE PUMPS



extend the advantages of the

UNIT-TYPE ROTOR ASSEMBLY

HIGHER SUSTAINED EFFICIENCY

Greater simplicity of design, with precision-matched impellers and channel rings, permits unusually high efficiency which is sustained throughout years of operation.

GREATER DEPENDABILITY

Radial balance with multiple-volute design and axial balance with opposed impeller grouping, assure long trouble-free operation. The smooth-bore, symmetrical outer casing eliminates any possibility of distortion under high temperature operation.

REDUCED MAINTENANCE

Entire rotor assembly can be removed from the casing as a single, compact unit, without disturbing piping connections. There are no ring fits to align on replacement of the rotor assembly.

to your medium pressure applications

• With the completely re-designed line of CNTA multi-stage pumps, Ingersoll-Rand offers a new high in performance, efficiency, dependability and economy—for medium-pressure boiler feed, mine dewatering, marine, petro-chemical and general hydraulic services.

The advanced design Unit-Type rotor assembly, with impellers and channel rings mounted on a single, heavy-duty shaft and with a smooth-bore outer casing, is the same type as that used by Ingersoll-Rand in the high-pressure CHTA and HMTA lines. The result of this modern construction is a dependable, simpler and more rugged unit that requires minimum attention and maintenance.

CNTA pumps are multi-stage, horizontally split units, with single-suction impeller groups placed back-to-back to eliminate hydraulic thrust. They are available in 4, 6 and 8 stages for pressures from 100 to 800 psi, in capacities from 50 to 700 gpm.

Your I-R representative will be glad to give you the *complete story.*

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

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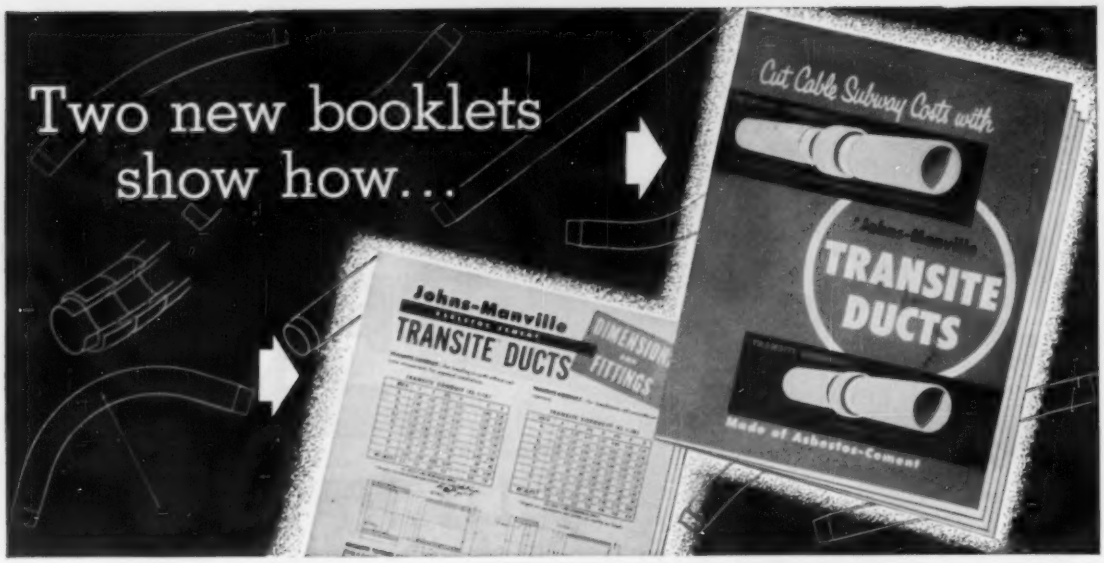
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES



Transite® Ducts cut cable subway costs—

give greater cable protection

Transite Conduit is the thicker walled duct which is used for exposed work or is laid directly in earth without a concrete encasement. Saves time, labor and materials on the job

Transite Korduct® is the thinner walled duct for installation in concrete. Inasmuch as it is used principally for hi-voltage lines, its high thermal conductivity reduces operating losses

• Johns-Manville presents these brochures as a service to public utilities, design engineers, and all other users and planners of cable subway systems. "*Transite Ducts*" shows how improved cable subway protection, installation, maintenance and operational savings may be achieved. "*Transite Ducts, Dimensions and Fittings*" give the necessary dimensional data on all ducts and fittings.

Transite Ducts offer improved cable subway protection. Made of asbestos and cement, Transite cannot burn, smoke, fume or generate explosive gases. Transite confines arc damage and protects adjacent cables against heat and flame. Transite resists corrosive action of soils; is unaffected by electrolysis.

Installation savings result because Transite is strong, light in weight, easy to handle. It comes in long, 10-foot sections, thus, fewer joints are required. Its permanently smooth bore prevents injury to cable either from natural movement or when pulling cable through. Maintenance savings result from the permanent nature of the asbestos cement composition of Transite. It is as durable as stone.

Moreover, operational savings result because cables run cooler due to the high thermal conductivity of Transite Ducts. This also results in prolonged cable insulation life.

For complete details on how Transite Ducts can cut cable subway costs for your system, send for copies of "Transite Ducts," EL-29A and "Dimensions and Fittings," EL-45A. Write to Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario.

JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Copper

or Aluminum?

Determine the Application then Specify...

MIDLAND

WEATHERPROOF WIRE

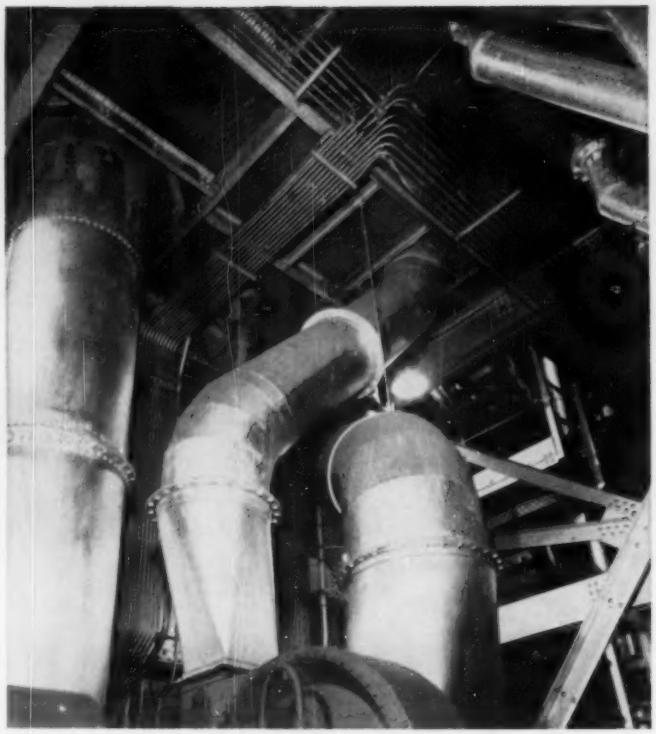
If the job calls for good distribution with a minimum wire diameter . . . where there are no hanging problems requiring special skills, special tools or accessories . . . and where high scrap value is to be considered . . . then copper is your answer. But if it's a long transmission run, specify Midland aluminum. But remember . . . whatever your weatherproof wire requirements may be . . . Midland can fill the order. Made to ASTM standards or your own special specifications.

Midland weatherproof cotton braided wire has been specially constructed to give you unusually long life with little or no festooning. Planetary stranding with a more flexible knitted covering that has been saturated at a uniform temperature and length of time during a separate operation is an "exclusive" with Midland and assures you of the very best. Look for the wire in the bright orange wrapper . . . it means quality . . . it's MIDLAND.

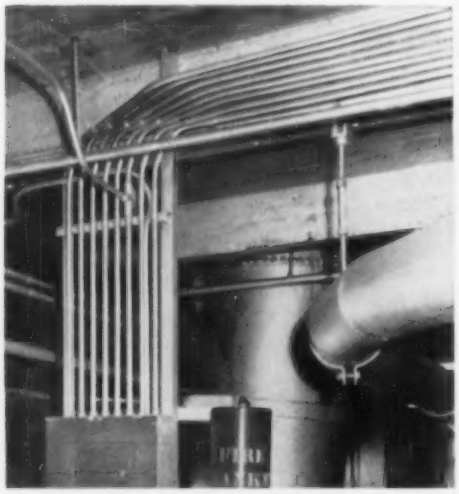
MIDLAND WIRE CORPORATION
DIVISION ESSEX WIRE CORPORATION
Factories at Birmingham, Alabama, Anaheim, Calif., Tiffin, Ohio

MIDLAND WIRE CORPORATION

25 YEARS and still going strong



There's no need to turn long runs of Republic E.M.T. Strong, compression fittings give lasting joints. And every coupling, every fitting, every panel or box connection is a union.



ELECTRUNITE E.M.T. can be installed in cramped spaces around beams, girders and other obstructions with no difficulty. Uniform ductility permits smooth multiple bending without wrinkling.

When the Cleveland Electric Illuminating Co. built its Ashtabula Power Plant nearly 25 years ago, a lot of Republic ELECTRUNITE E.M.T. was installed. Today, this E.M.T. is still giving efficient, trouble-free service —with no end in sight.

Long-lasting dependability is one big reason why public utilities with a reputation for service consider Republic Electrical Metallic Tubing a good investment —and continue to use i in new installations.

Republic E.M.T. is the original lightweight, threadless rigid steel electrical raceway. Since threading is not necessary, the galvanized zinc coating is unbroken—providing end-to-end circuit protection against moisture, fire and mechanical injury.

It's easy to bend, too. Uniform ductility throughout every length makes possible 90° bends, with smooth and unwrinkled surfaces inside and out. Exclusive "Inch-Marks" and "Guide-Lines"—plus its light weight —help keep installation costs down.

This is just part of the story. If you're building, remodeling or expanding, get all the facts on Republic E.M.T. It's produced to A.S.A. Specification C80.3, approved by Underwriters' Laboratories. Write for Booklet SA-55.

REPUBLIC STEEL

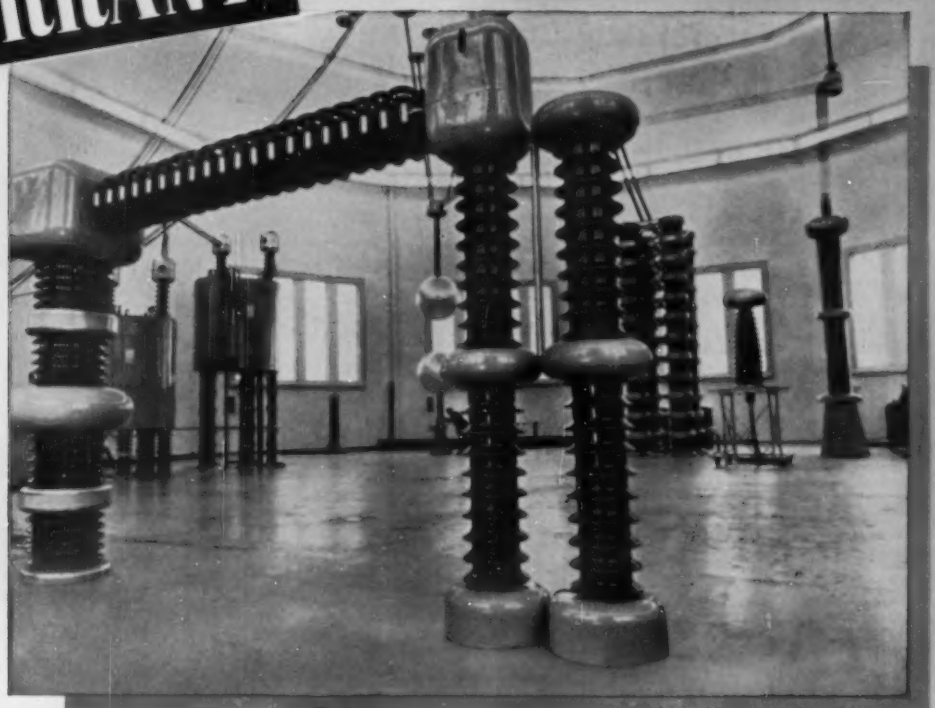
STEEL AND TUBES DIVISION • 213 E. 131st STREET • CLEVELAND 8, OHIO

World's Widest Range of Standard Steels and Steel Products

Made by the producers of ELECTRUNITE . . . The Original Electric Welded Boiler Tube

FERRANTI

HIGH VOLTAGE TESTING EQUIPMENT



IN NORWAY

The Testing Equipment illustrated has been supplied by Ferranti Ltd to the Research Laboratory of Standard Telefon og Kabelfabrik A/S, Oslo, Norway. It consists of :

Foreground : 1,000,000 volt D.C. Testing Equipment.

Left . 600 kV, 1,200 kVA , A.C. Testing Equipment.

Background : 12 Stage 2,000,000 volt Impulse Generator.

A 1,500 mm sphere gap and surge potentiometer can also be seen in the background.

TRANSFORMER CAPACITY OF OVER 5,000,000 kVA PER ANNUM

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C., D.C., and Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD. Head Office and Plant : HOLLINWOOD · LANCASHIRE · ENGLAND

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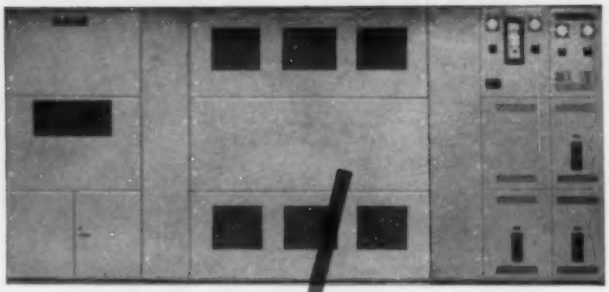
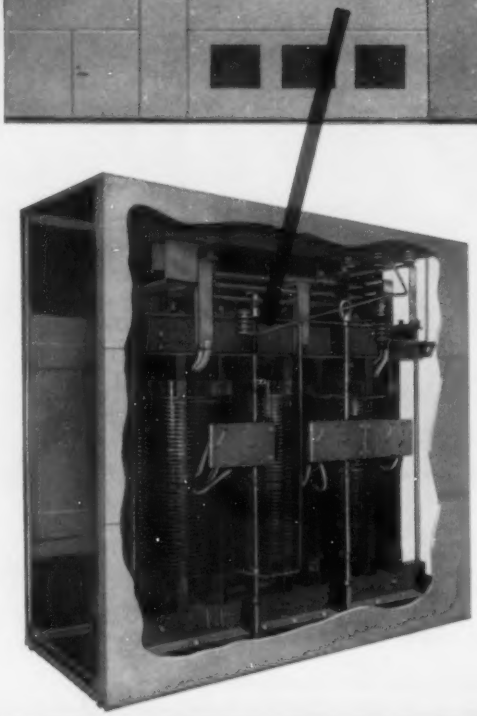
PROTECT YOUR INVESTMENT

Specify KUHLMAN power center transformers — built for dependable service — designed for your job specifications



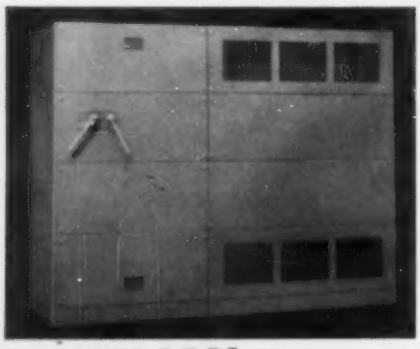


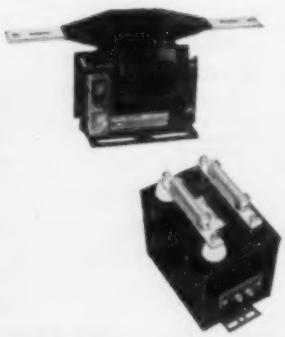
KUHLMAN Dry-Type Transformers

- Class "B" insulation is designed for a maximum 80° rise over ambient temperature of 40°C.
- Dry-Types can be supplied as core and coil units or as complete sections with sheet metal enclosures.
- All units match specified high and low voltage switchgear and can be installed close to the center of the load areas, thus providing better voltage regulation and eliminating long secondary runs of copper.
- Standard assemblies can be used as either right or left hand units.
- Taps are conveniently located.
- Automatic forced air cooling can be provided for additional over-load capacity.

PUT POWER WHERE YOU WANT IT—YOUR CHOICE OF KUHLMAN DRY-TYPE

Dry-type Power center for supplying power to individual production machines — reduces line losses and voltage drops — is installed at machine location.





Potential and current transformers for operating relays, tripping devices, and metering applications.

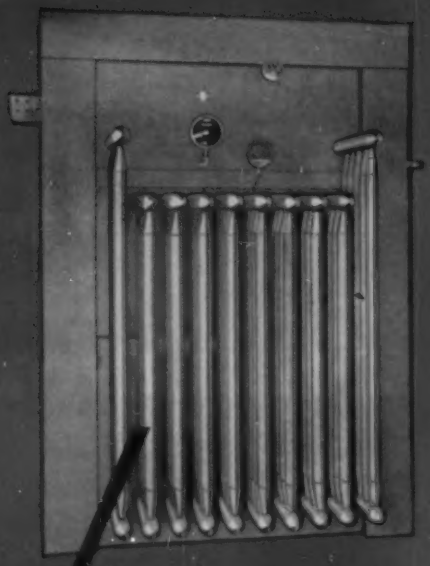
Dry-Type distribution transformers, either floor or wall mounted—600 volts and below, for machine tools and lighting circuits.

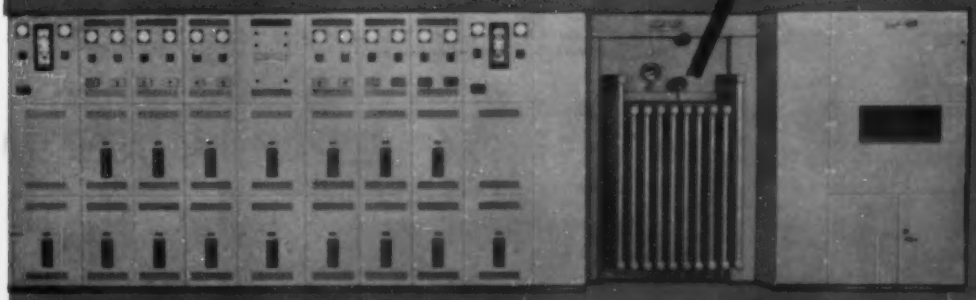
KUHLMAN ELECTRIC CO. BAY CITY, MICH. • CRYSTAL SPRINGS, MISS.

IN MODERN PLANT EQUIPMENT

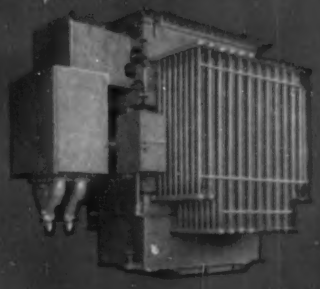
KUHLMAN Liquid-filled Transformers

- Standard accessories on all units include: ground pad, tap changer and handle, name plate, magnetic liquid level gauge, tap filter valve, liquid temperature indicator, drain valve, pressure vacuum gauge, and jack bosses.
- Special accessories include: Provisions for fans and forced air cooling, alarm contacts for temperature, pressure, and liquid level gas absorber and other special equipment.
- Where required units are supplied with a safe, non-inflammable cooling fluid and can be installed without vault protection.
- Kuhlman liquid-filled transformers are designed to match the specified low and high voltage switchgear for either flush end or throat connections.
- Units are compact for easy installation and quick plant change-overs.

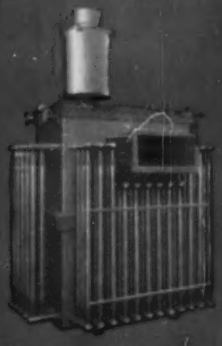




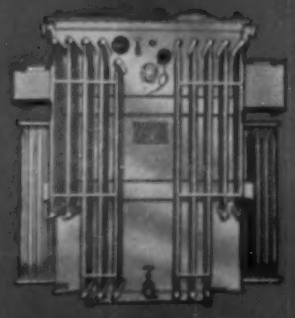
OR LIQUID-FILLED TRANSFORMERS FOR EVERY JOB APPLICATION



Typical outdoor liquid-filled transformer equipped with high voltage switches serves as a power center for distribution systems.

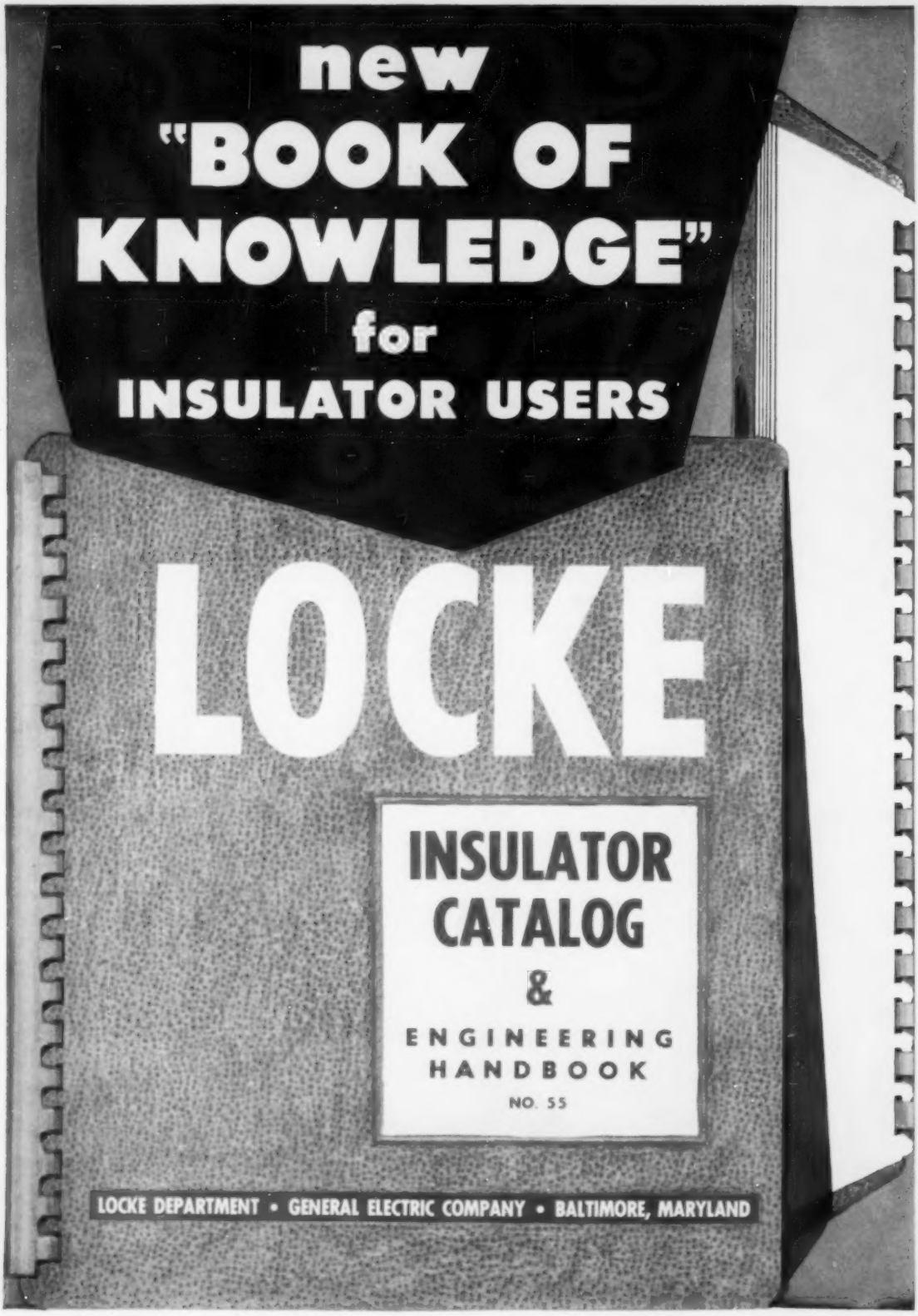


Liquid-filled unit equipped with a gas absorber and a relief device for relieving abnormal pressures.



Liquid-filled unit with throats for indoor or outdoor installation in locations where transformers are throat connected to switch-gear cubicles or bus.

SALINAS, CALIFORNIA


new
"BOOK OF KNOWLEDGE"
for
INSULATOR USERS
LOCKE
INSULATOR CATALOG
&
ENGINEERING HANDBOOK
NO. 55
LOCKE DEPARTMENT • GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

Locke's Insulator Catalog and Engineering Handbook

Designed to become your favorite source for complete, authoritative purchasing and engineering information on insulators and insulator hardware.

Included in its 233 pages of easy-to-use, alphabetically and numerically indexed material, you'll find these important features:

1. A completely new insulator product section, thumb indexed, makes it easy for you to quickly locate any one of over 800 insulators or insulator hardware items.
2. Complete description of physical characteristics of porcelain.
3. Six pages of clamp recommendations for various conductors.
4. Large section on lightning performance of transmission lines.
5. An expanded section on apparatus bushings with application and maintenance information.
6. Complete listing of all EEI-NEMA Standards, including proposed standards for apparatus insulators. (TDJ-58, 59)
7. The complete American Standards for apparatus bushings and test code.
8. A large general data section including standard insulator tests, cable specifications and many valuable tables for general calculations.

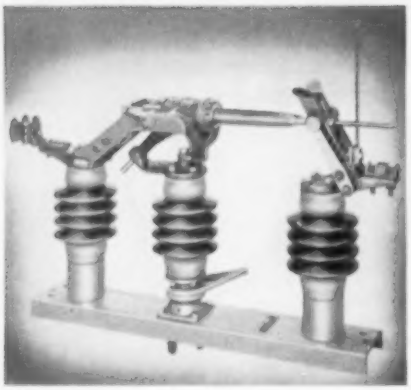
Your copy of this lightweight, spiral bound Insulator Catalog will be supplied by your local Locke Representative.

LOCKE

HAVE YOU SEEN THIS

NEW AF20

Vertical Break Switch with Rotating Blade



All the best in recent switchgear trend . . . rotating blade for easy action . . . high pressure contacts at both ends . . . heavy silver surfaces at *all contacts* . . . safety lock at open and closed positions.

Rotating method makes operation easier. In opening, the initial torque is concentrated on rotating the blade. This releases all contact pressure before the blade rises appreciably. Further operation raises the blade to full open position, and is remarkably easy because only the weight of the blade is concerned.

Ideal direct current path . . . with a minimum of contact points. A hard drawn copper blade nestles between identical contact systems at the front and hinge ends, so the current enters and leaves under the same conditions.

Front contact. Highly flexible system with silver inlays gives ideal contact plus long wear.

Hinge end view. Note rugged construction and 3E's strong, simple blade assembly.

NEW BF20

Side Break Switch

A completely new switch, with many advanced features that make it the best buy in low cost, outdoor switchgear . . . and its long life is assured by sound design, a minimum of parts, and extra heavy construction. Typical of the quality products that have established Three-E's reputation.

Front contact in open position.

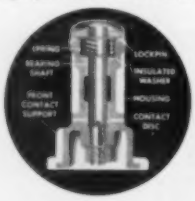
CHECK THESE MODERN FEATURES

1. Simple, rugged design.
2. High pressure silver contacts, braidless for longer life.
3. Toggle motion, positive ice breaking and wiping action.
4. The switch can be assembled for right or left hand operation, with the same components.

Available through 161 KV, 600 Amp and 1200 Amp.

Rugged construction of high pressure rear contact.

The current travels through the front contact bearing unit, which rotates to give the toggle action, and is transferred to the support at the silver contact disc. An insulated low stressed, stainless steel coil spring keeps the two parts under high pressure contact at all times.



YEAR'S NEW 3E SWITCHES?

NEW AG20

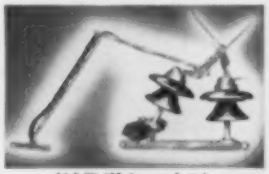
Self-Aligning Tilting Insulator Switch

ELIMINATES CROSS ARM WARPAGE PROBLEM

3E Gives Tight Closure Even When The Support Is Warped

1. Wide rounded contact for easy entry
2. Ample lateral motion
3. Blade pivots on full-floating pin for rocking action

If you are looking for safe, sure, low cost switchgear . . . the 3E Tilting Insulator Switch is the answer. It can be easily and quickly installed . . . will align itself and operate effectively regardless of the pole's condition.



34.5 KV 400 Ampere Switch

NEW BF21

Outdoor Interrupter Switch

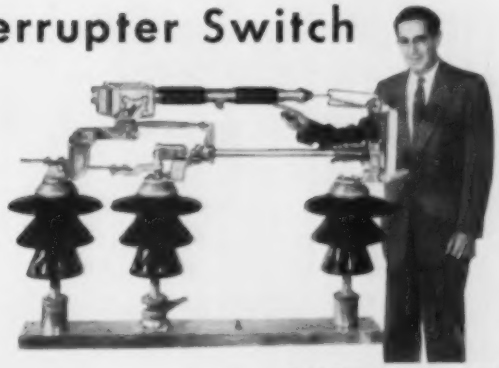
FOR INTERRUPTING FULL LOAD CURRENT OF LINES AND PARALLEL LOADS.

Constant High Speed Interruption. Contact speed is independent of the time taken to operate the switch for both opening and closing. The interrupter unit for each pole of the switch has its own self-contained high speed mechanism.

Completely Confined Arc. Interruption takes place inside the arcing chamber, where the arc created by the interruption is confined and extinguished.

Fast, Clean, Interruption . . . one cycle or less.

Dry Type Interrupter Unit. The arc is interrupted in the arcing chamber by the pressure and effective blast of gases produced by the action of the arc upon solid material enclosed in the arcing chamber, and no oil or air blast is required.



R. W. Dittus, 3E Sales Manager pointing to the interrupter unit of the new BF 21 side break interrupter switch.

Overload Can't Damage Interrupter Unit. The interrupter is out of the circuit when the switch is in the closed position. The new BF 21 is now catalogued in units through 46 K.V.

Write for full data on these new switches.

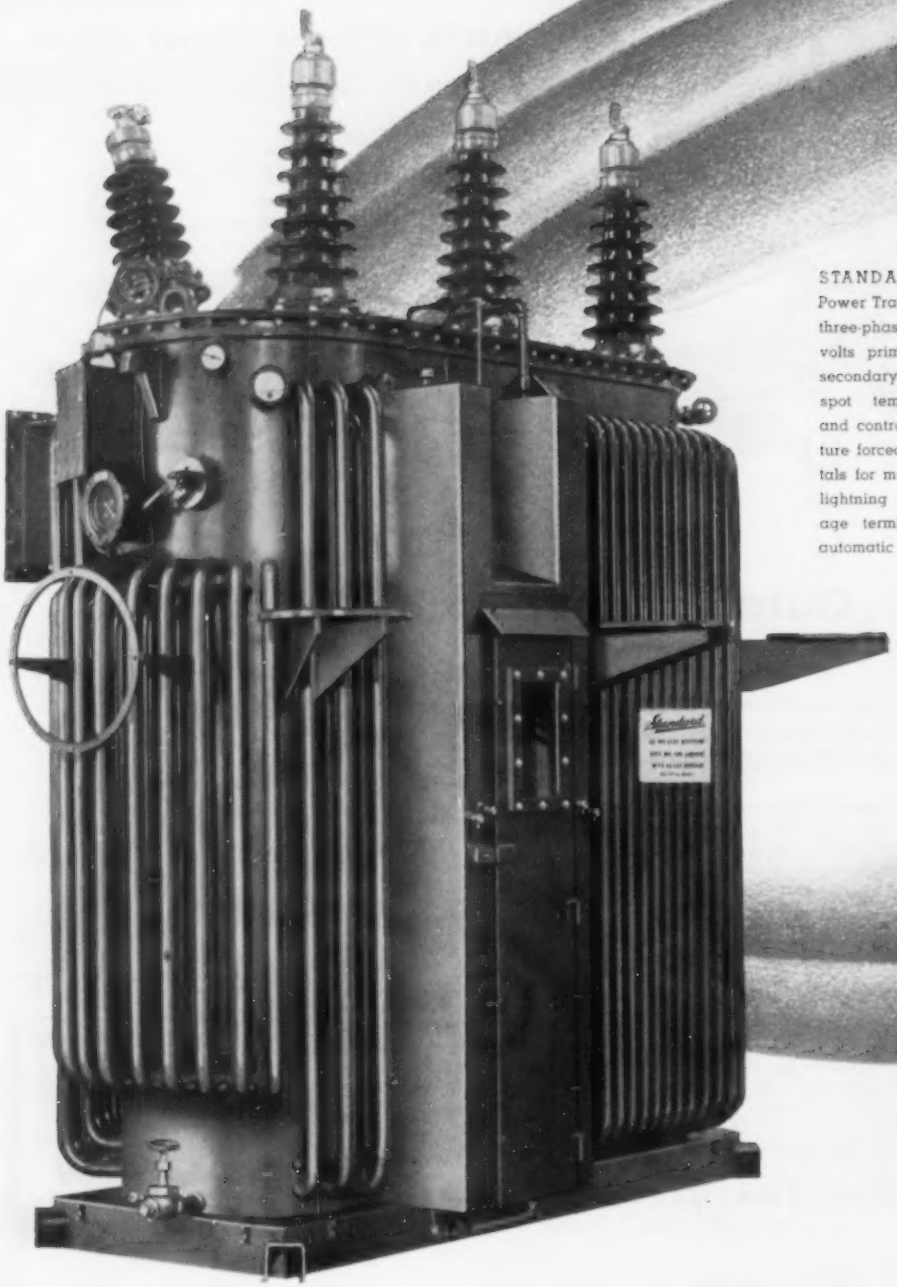
ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS

3E

Standard® POWER

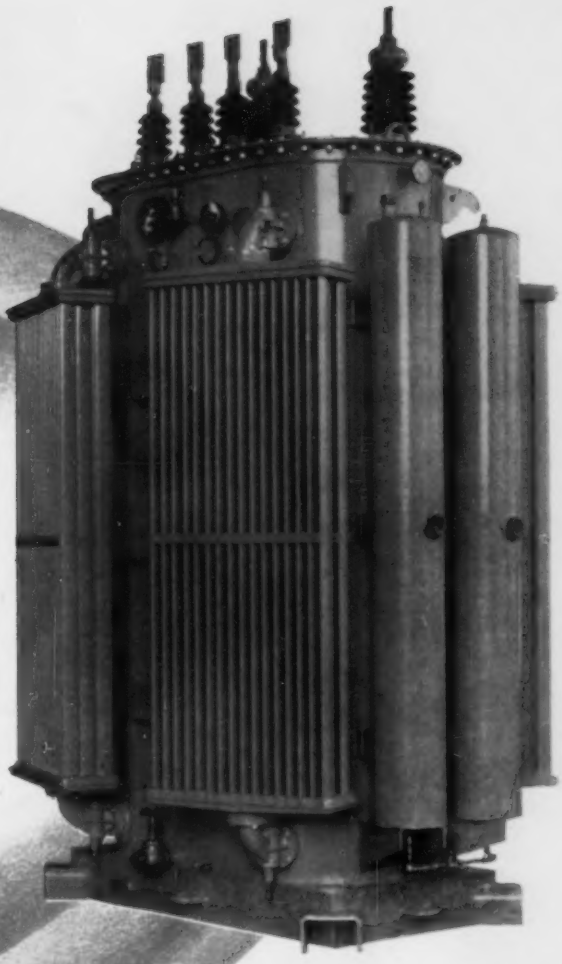
efficient . . . economical



STANDARD Type ATAB Power Transformer, 1500 KVA, three-phase, 60-cycle, 69,000Y volts primary, 480x240 volts secondary. Equipped with hot spot temperature indicator and control, provisions for future forced air cooling, pedestals for mounting station-type lightning arresters, low-voltage terminal chamber, and automatic gas seal equipment.

TRANSFORMERS

. . . dependable



● Where power requirements demand above-average reliability and efficiency, Standard Power Transformers are your one best choice. Figures taken from service records show how Standard's sound engineering principles cut maintenance costs to the bone and boost transformer life.

Standard engineers work with your engineers to incorporate the transformer design features and specific components that meet your needs most efficiently. Bushings, tanks, finishes, covers, and accessories meet ASA specifications and are rigidly inspected by Standard. Each transformer, regardless of size, is subjected to all standard commercial tests—both during and after manufacture.

We can build transformers to your specifications as quickly and economically as if you'd bought repetitive designs.

There's a Standard Transformer representative near you. Call him. He'll work with you to produce the best transformers you've ever used.

2500 KVA, single-phase, OISC power transformer, 34,500 volts primary, 2400x4800 volts secondary. Special design to meet customer's specifications. Standard engineers will work with you to meet your requirements.

Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

Transformers

FOR EVERY APPLICATION

Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)

Instrument transformers (for use on circuits up to 72,000 volts, inc.)

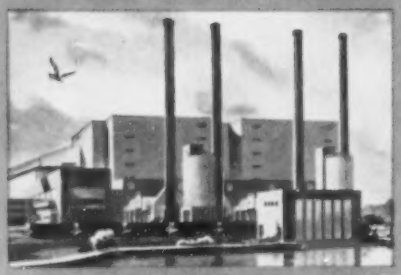
Dry type (up to 1000 KVA and max. voltage ratings of 4800.)

Control transformers (compound filled or open type.)

1 **KANAWHA RIVER** 9113

Appalachian Electric Power Co.
on the American Gas and Electric System

Two B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.



2 **ST. CLAIR** 9240

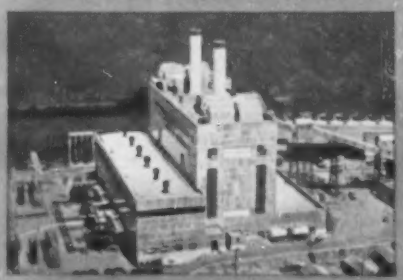
Detroit Edison Co.

Four B&W Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.

3 **TANNERS CREEK** 9251

Indiana and Michigan Electric Co.
on the American Gas and Electric System

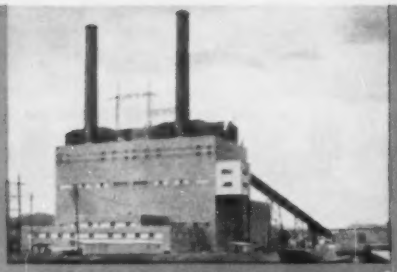
Three B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.



4 **SHAWVILLE** 9310

Pennsylvania Electric Co.

Two B&W Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.



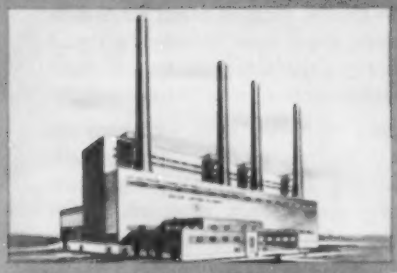
5 **MUSKINGUM RIVER** 9374

Ohio Power Co.
on the American Gas and Electric System

Two B&W Pressure-Fired Open-Pass Reheat Boilers with Gas Recirculation.

6 **EASTLAKE** 9386

The Cleveland Electric Illuminating Co.



7 **PHILIP SPORN** 9417

Appalachian Electric Power Co. and Ohio Power Co.
on the American Gas and Electric System

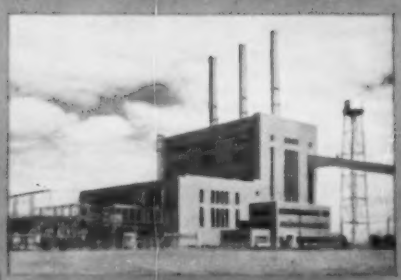
Four B&W Pressure-Fired Radiant Reheat Boilers with Gas Recirculation and Divided Furnace Construction.

8 **KEARNY B** 9556

Public Service Electric & Gas Co.

9 **BARRY** 9557

Alabama Power Co.



10 **JUSTIN R. WHITING** 9574

Consumers Power Co.

Three B&W Radiant Reheat Boilers.

10 BEST ANNUAL HEAT RATES

reflect INCREASING EFFICIENCY in power generation

Annual plant net heat rates of the ten most efficient central stations in the United States in 1954 — as reported by the Federal Power Commission — are led by Kanawha's record 9113 Btu per net kwhr. They are strong vindication of the foresighted utilization of major engineering advances which are taking this nation so far and so fast along the road of power generation progress. And the development of these advances has been possible only through the efforts of the electric companies and their primary suppliers working cooperatively to provide more electricity more efficiently.

In most of these leading stations, B&W Boilers designed with the most advanced features are contributing substantially toward achieving the remarkable plant efficiency levels reported. For example, at Kanawha the B&W vertically-fired Radiant Boiler units utilize:

PRESSURE-FIRING
To eliminate air infiltration, reduce stack loss and assure greater efficiency.

CYCLONE STEAM SEPARATORS
To assure positive natural circulation at high pressures with lowest auxiliary power cost, and send steam of highest purity to the turbines.

DIVIDED FURNACE CONSTRUCTION
To hold building volume to the minimum while achieving required furnace cooling surface.

Just behind the ten leaders are more plants — many with B&W Units — producing abundant, economical power in all parts of the country.

Welcoming its responsibilities as a major supplier, B&W continues to apply the knowledge derived from almost a century of boiler engineering, design and fabrication experience. And to help foresee the needs of the future, the practical results of an extensive B&W program of research and development are continuously being enlisted in the efforts to achieve still higher levels of steam-electric generating efficiency.

G-738

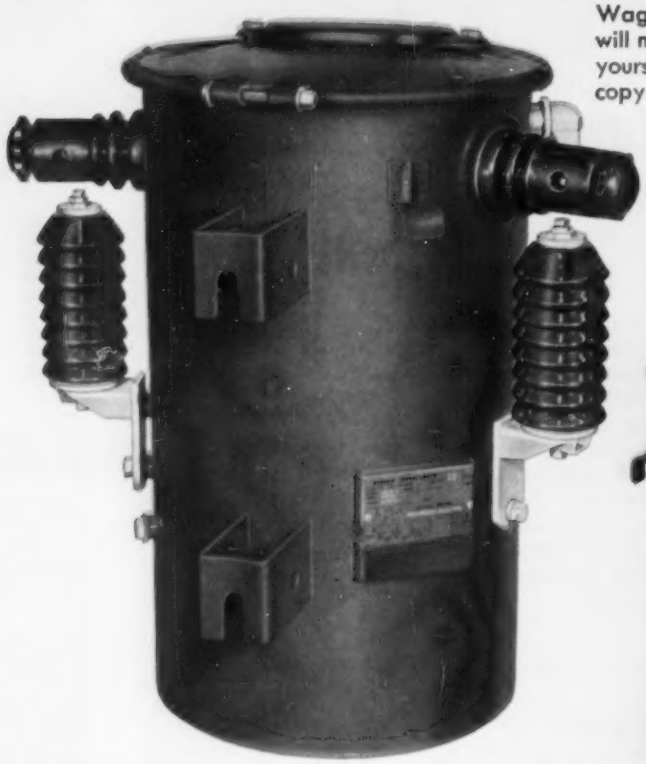
BABCOCK & WILCOX

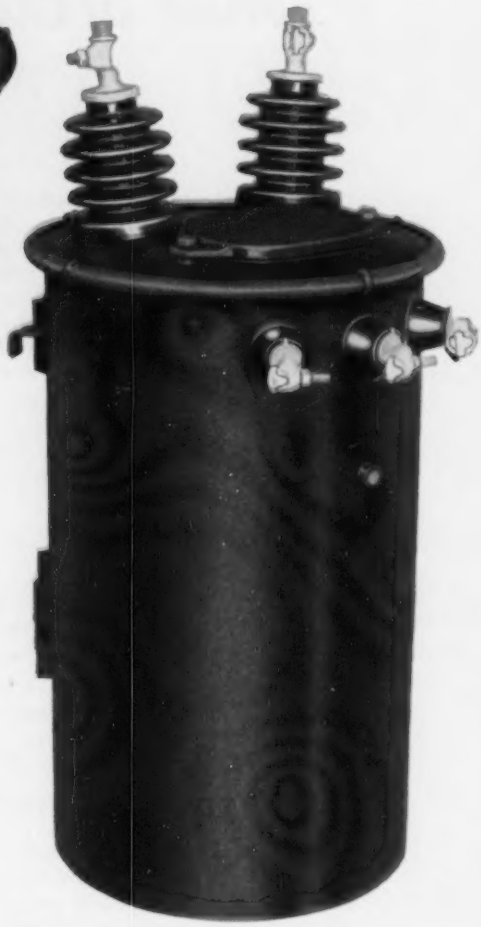
BOILER DIVISION

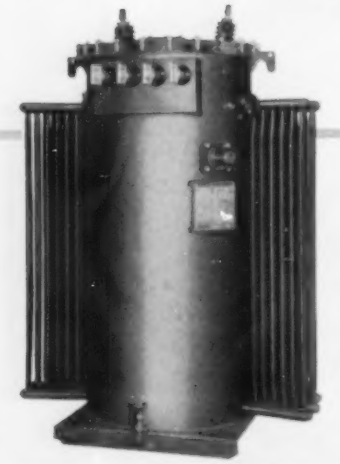
Wagner®
TRANSFORMERS
...the choice of leaders in industry

Here's why it pays to

Wagner Form W Distribution Transformers will meet *your* requirements. Full details are yours in Bulletin TU-180. Write for your copy today.







Form W Construction available in ratings up to 500 Kva

You can get Wagner Form W Transformers in a complete range of ratings, from 3 to 500 Kva, with protective features to meet your needs.

Wagner Electric Corporation
EST. 1891

choose Wagner Form W Transformers...

FORM W ELEMENT

Wagner Form W Transformers pay dividends in longer service life. The Form W element, with preformed cores of cold rolled, oriented grain steel, permits a liberal design in small size, lightweight transformers that give excellent electrical performance. And, whenever you buy a Wagner pole type Distribution Transformer, you get a transformer with many important *extra* features.

NEW LOCKED LOW VOLTAGE BUSHING

This secondary bushing is key-locked to prevent rotation. The terminal is locked to the porcelain, too, so it is impossible for the assembly to slip or turn when the terminal is being tightened or loosened. No more loose inner terminal connections to cause internal shorts.

NEW HIGH VOLTAGE SIDEWALL BUSHING

This bushing, for use with either copper or aluminum conductor, permits FASTER connections —conductor is simply pushed into the connector and held tightly with a few turns of the knob ... EASIER connections—no tools are needed ... SAFER connections—insulated knob protects lineman when tightening the terminal.

SHUR-SEAL COVER

Wagner pole type transformers are sealed air-tight. The Shur-Seal cover is fitted with a clamping ring that firmly seals the cover to the tank. No atmospheric moisture or dust particles can get inside. Although this construction is as air tight as a welded tank, the cover may be removed by just loosening a single, stainless steel bolt.

INHIBITED OIL

You get extra years of service from Wagner distribution transformers because the Wagner 7NI oil used in these transformers reduces oxidation to a minimum and retards the formation of acids and sludge.

T55-13

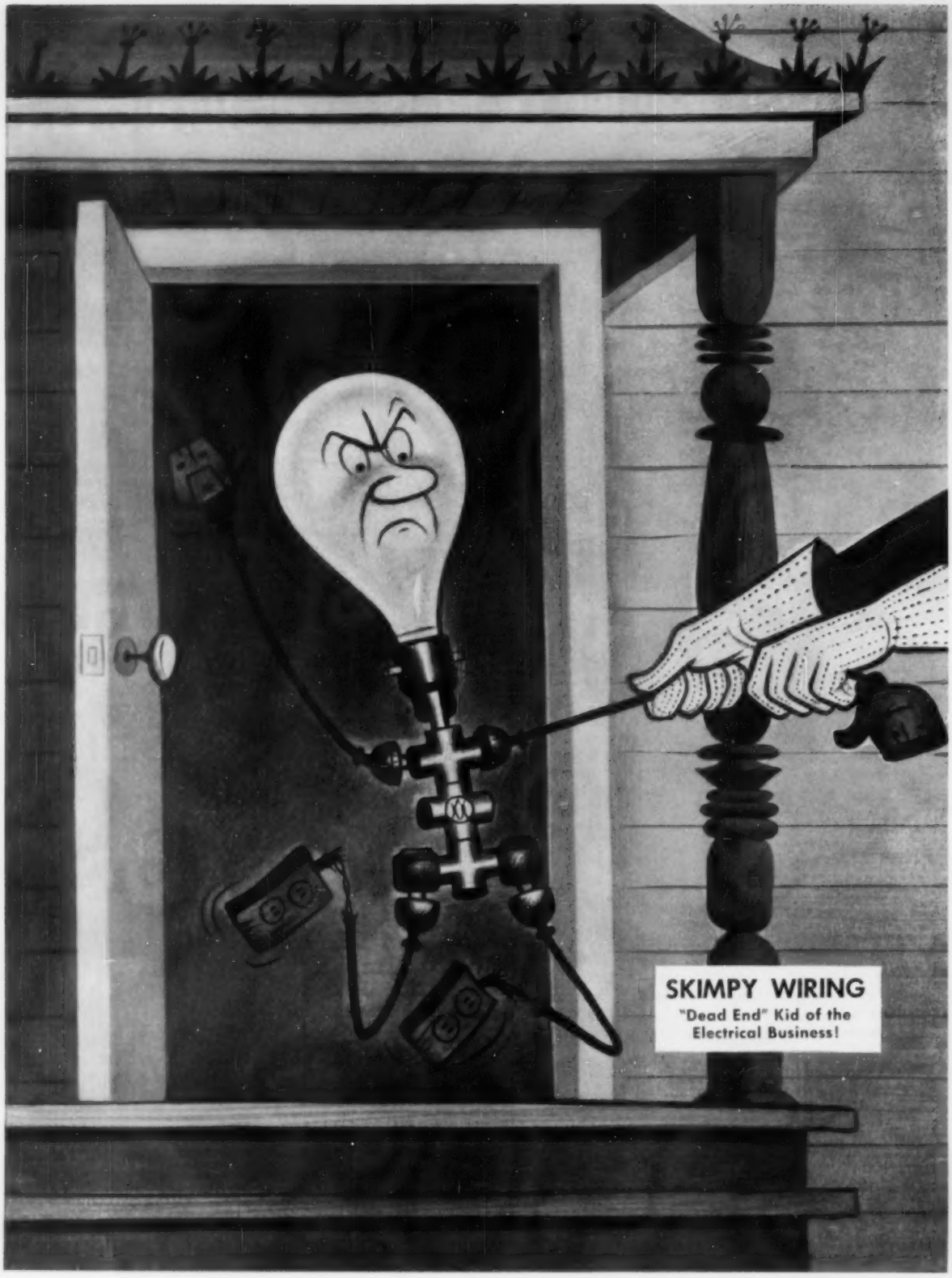
AND...THEY'RE SHIPPED IN DRUMS!

Wagner Type HEF and HEK Transformers from 3 to 10 Kva are now packed in sturdy fiber drums for ease of shipping, handling and storage. Each drum is sealed, so that when you open it, the transformer is free from dust and grease—as clean as it was the day it left the Wagner plant.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES


SKIMPY WIRING
"Dead End" Kid of the
Electrical Business!

WE'RE PULLING HIM OUT OF HIDING!

Kennecott is exposing Skimpy Wiring...to help you sell more power!

There he is! Skimpy Wiring — the underhanded rascal who's blocking power sales in more than 80% of the homes in your area!

Hiding unnoticed in the walls of your customers' houses, Skimpy Wiring represents the biggest single threat to the electrical business today. However, once Skimpy Wiring is exposed, folks see him for what he really is — an electrical troublemaker who should be done away with!

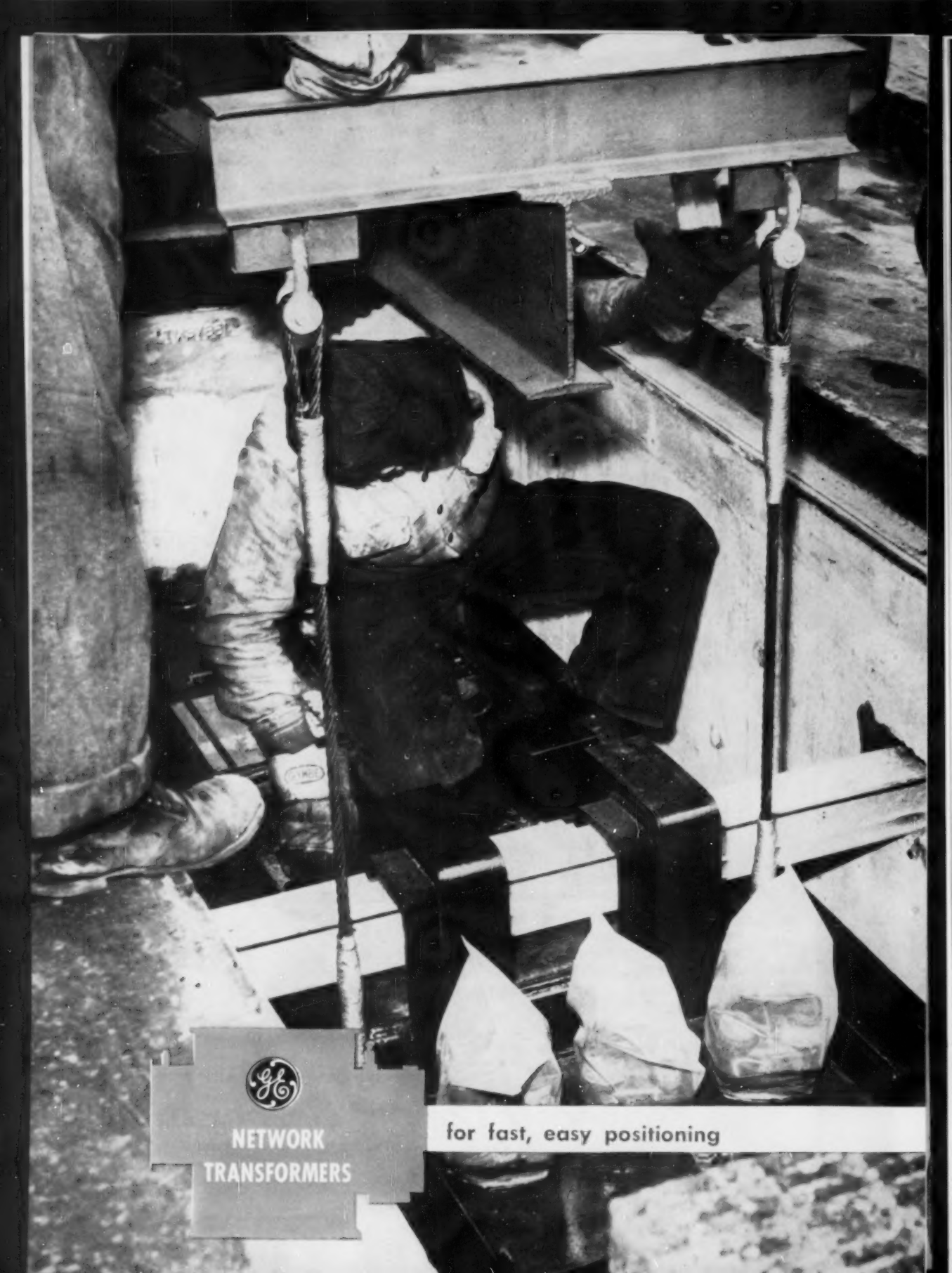
That's the reason for full-page Kennecott ads like the one shown below. They hammer home the story of safe, adequate wiring. Co-ordinated with your own efforts, Kennecott's campaign will add national impact and prestige to local adequate wiring promotions, can help boost your sales of power! Tie in with it now!

FREE! TIE-IN MATERIAL!

Send today for free reprints and poster-size blow-ups of Kennecott Saturday Evening Post and This Week magazine ads. Get free copies of the educational booklet, "The ABC of Home Wiring." Ask for complimentary Home Wiring Wall Chart, mat service folder and list of *at-cost* prices of all available material. No cost, no obligation! Simply write Kennecott Copper Corporation, Dept. W125, 161 East 42nd Street, New York 17, N. Y.

Kennecott Copper Corporation

Fabricating Subsidiaries: CHASE BRASS & COPPER CO. • KENNECOTT WIRE & CABLE CO.


NETWORK
TRANSFORMERS
for fast, easy positioning

NEW SUSPENSION MOUNTING

reduces positioning time for G-E network transformers to minutes instead of hours

A new design idea—suspension mounting—now greatly simplifies installation and maintenance of network transformers.

Developed jointly by General Electric and Consolidated Edison Company of New York, suspension mounting enables you to position a transformer in a fraction of the time formerly required. Vault floors need not be level. Furthermore, your construction men can quickly level the transformer since it is much easier to shim an I-beam cross bar before hanging a transformer from it than to shim a transformer after placing it on a vault floor. The Consolidated Edison men placed their first unit in position and levelled it in less than 10 minutes!

MAINTENANCE IS SIMPLIFIED, TOO

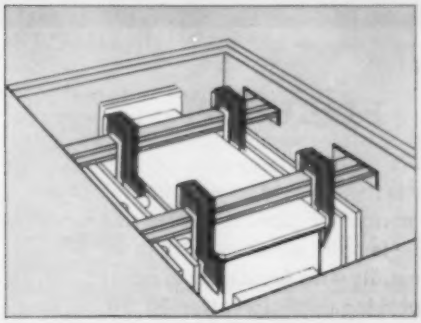
With suspension mounting, the transformer is 8 to 10 inches above the floor of the vault, away from corrosive elements such as sewage, dirt, and chemicals, which collect in most vaults. This retards corrosion of the tank, making it necessary to clean the vault far less frequently than when the transformer is set on the floor. When cleaning becomes necessary, it's easy to flush out the vault because there is clear passage under the transformer.

It's also easy to clean and repaint the transformer. Radiators are of the panel type, with large flat surfaces easily accessible from the top or ends. Just use a long-handled brush or nozzle.

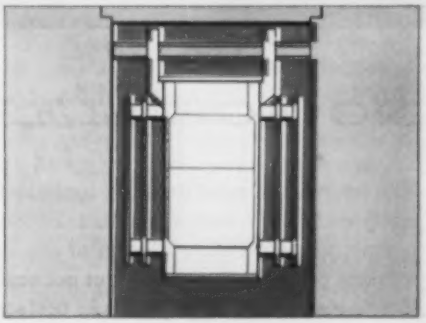
Maintenance is simplified in other ways, too. You can remove bushings, for example, from the outside of the tank. There are no large gaskets to replace. Accessories are located on the high-voltage end of the transformer where you can easily reach them. It's easy to inspect the network protector because it slides out on rails.

HELP FOR YOU

For help in solving your network problems and for complete information on the advantages of suspension-mounted G-E network transformers, see your local G-E sales representative. General Electric, Schenectady 5, N. Y. 415-4



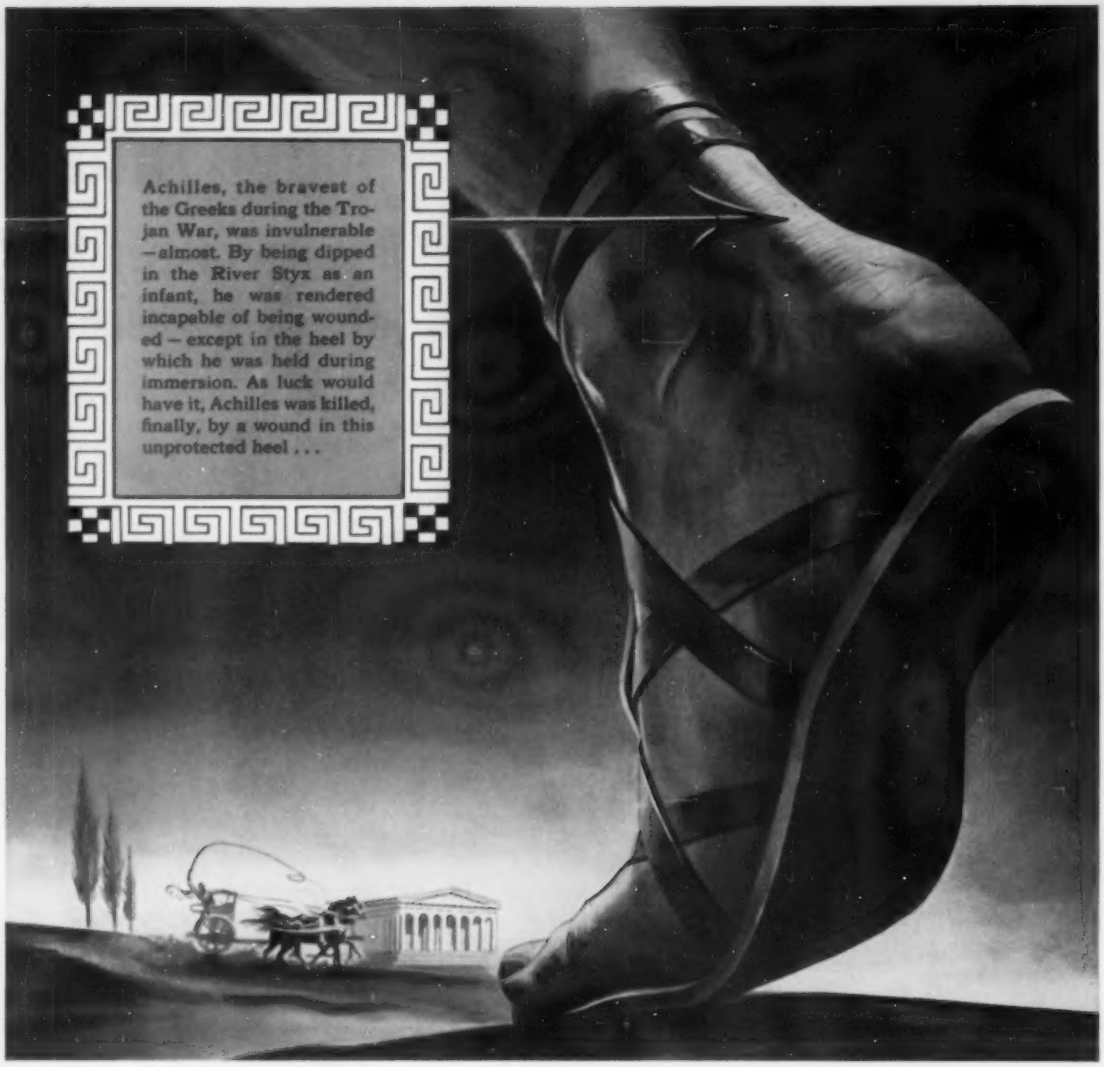
SUSPENSION MOUNTING. Two sturdy hooks rest on I-beams installed above transformer. Each beam rests on bearing plate in side-wall recess.



PLENTY OF SPACE under transformer keeps it above chemicals and debris, retarding corrosion and permitting fast and easy cleaning of vault.

Progress Is Our Most Important Product

GENERAL ELECTRIC


Achilles, the bravest of the Greeks during the Trojan War, was invulnerable—almost. By being dipped in the River Styx as an infant, he was rendered incapable of being wounded—except in the heel by which he was held during immersion. As luck would have it, Achilles was killed, finally, by a wound in this unprotected heel . . .

NO ACHILLES HEEL

The final test of most products for industry is their ability to withstand—*completely*—the corrosive effects of long periods of time. In cables this is especially true, since no part of any cable is more serviceable than its weakest point. Fortunately—but not accidentally—no Achilles heel limits Kerite insulation. Kerite cable in perfect working condition after 40, 50, and more years of difficult service is the rule, rather than the exception.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

EDITORIALS

Adequate Wiring Is Everybody's Business

Adequate wiring promotion must have wider industry and business support if it is to do the big job set out for it. Everybody can agree on this even though there may be concern over wiring certification (p 92).

Main aim of adequate wiring promotion is a broad public awareness of the necessity and value of adequate wiring. It should become a household word like brand-name products. Potential home-buyers should check their wiring jobs as carefully as they check their deeds.

A vital step in creating this sort of public awareness comes in gaining the enthusiastic support of all businesses and industries which have a direct or indirect stake in adequate wiring. Their financial as well as their moral support is needed to put over the kind of nationwide campaign which is so critically needed.

Adequate wiring needs the support of banks and investment houses which furnish the commercial credit for electrical manufacturers and utilities, hold home mortgages, or have a hand in the financing of rewiring jobs.

Adequate wiring needs the support of insurance firms which have a direct interest in the additional protection which adequate wiring gives against accidents and fires.

Adequate wiring needs the active support of every businessman, every supplier, every manufacturer who is a part of the electrical industry. They need to be told of their stake in adequate wiring just as the homeowner is told of his.

This campaign for broader support calls for a selling job paralleling other adequate wiring promotion. It offers the rich possibility of drawing help which will pyramid present adequate wiring programs into harder-hitting campaigns.

This means selling hard the idea that adequate wiring promotion is everybody's business. It's the surest way we know of convincing the public that adequate wiring is its business, too.

"Voluntary" vs "Government" Ownership

The recent announcement that Ford Motor Co common stock will be sold on the open market was hailed in the general press as a shift from "private" to "public" ownership. This leads us to consider the designations applied to electric utilities.

All electric utilities, by their very nature, serve the public. There is general agreement that they should be called "public utilities." There is not much argument on that score.

It is when we try to describe the ownership of these utilities that we run into trouble. The commonly accepted differentiation as of now is "publicly owned" as against "privately owned." Simplified for headline use, these become "public vs private power."

The "publicly owned" are really those owned by some government body—local, state, or federal. There seems to be some semantic advantage in the designation even though it would be more accurate to call them "government-owned" utilities.

The actual financing for these utilities is either provided or underwritten by the taxpayers. In the case of federally owned, and probably some state-owned utilities, the taxpayers have never had a chance to vote directly and exclusively on the issue of government ownership of power facilities. On the part of many taxpayers the financing and ownership have been a non-voluntary matter. So for those taxpayers, anyway, there would be some validity in designating these utilities as "non-voluntarily owned."

Turning now to the "privately owned" utilities, we find that thinking relative to the Ford stock sale would lead us to designate these as "publicly owned." In commenting on this thought recently, Edison Electric Institute President Harllee Branch, Jr, said the investor-owned companies are "the most public of all business enterprises." He noted that they are owned by about 3½ million direct shareholders and are partially financed by another 90 million indirect bond holders. Certainly as far as the shareholders are concerned, they are for the most part voluntary owners.

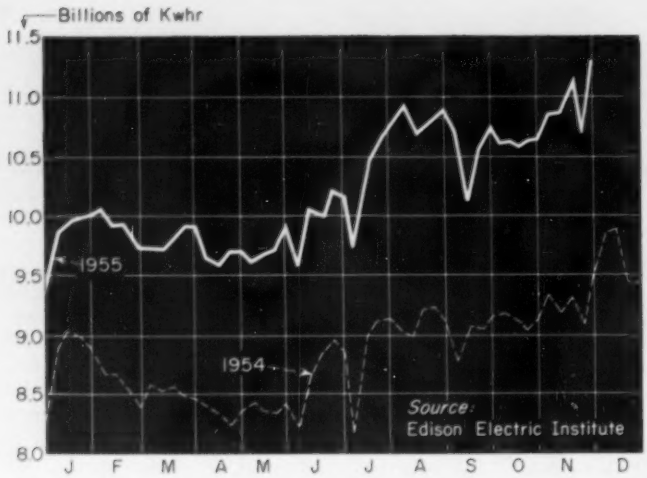
Thus we find at least two additional ways of differentiating:

"Voluntarily owned" and "non-voluntarily owned."

"Publicly owned" and "government owned."

These designations have more accuracy and more validity. But names have a way of becoming fixed. Until electric companies make a conscious effort at change, we can expect that the common differentiation will remain "public" and "private" power.

ELECTRICAL WEEK



OUTPUT

Week Ended Dec. 3
11,359,000,000 Kwhr
Up 18.2%

Atomic Energy Commission requirements — 1,086,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 13.1%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Dec. 3	+18.2	+9.3	+10.9	+28.6	+14.7	+19.4	+14.0	+13.9	+18.9	+10.9
Nov. 26	+18.0	+11.4	+9.2	+27.3	+10.4	+18.3	+15.7	+16.4	+25.2	+15.0
Nov 19	+19.7	+10.9	+10.3	+28.9	+14.2	+19.8	+16.0	+18.4	+29.1	+16.5

Seasonally Adjusted Index 211.7 Week Ago 211.0 Year Ago 179.2

The Issue's Highlights—Coal as power source for aluminum reduction speeds ahead as Ohio Power undertakes to supply 450,000 kw to Kaiser Aluminum which plans $280-million expansion in Ohio Valley . . . Westinghouse cuts top management pay 50%, introduces employee furloughs to cope with strike conditions . . . Sen Kefauver pushes scandal search in Dixon-Yates contract negotiations; queries Strauss, Hughes, and Demmler . . . South Carolina E&G's proposed Saluda River steam plant has unique design features . . . Idaho Power sets Christmas eve deadline for new Northwest Power Pool tie.

Extent of Atomic Power—To date a total of about $300 million has been earmarked to provide about 800,000 kw of atomic power over next six years.

Rates and Regulatory—Franklin County Circuit Court, Kentucky, has upheld Kentucky Railroad Commission's order fixing lower intrastate fine coal freight rates for deliveries to Kentucky Utilities' Tyrone Plant. Order requires five railroads to refund KU $227,764 in excess rates . . . Attorney James F. Gordon has accepted Kentucky Governor-elect A. B. Chandler's invitation to be PSC chairman, replacing Robert M. Coleman whose term expires Jan. 2 . . . PSC has completed hearings on proposal to discontinue dc service in Louisville, Ky.

Yardstick for Federal Power?—This suggestion was made last week by Ernest R. Fatland, Oregon ex-state senator, to Congressional subcommittee hearings in Portland. Enough "yardstick" power installations had been built by government, he said, and "now is the time to let private taxpaying enterprise create some of the yardsticks by which government efficiency may be measured.

Labor—Back to work movement of Westinghouse strikers expanded last week and at last check 945 were back on refrigerator production at Columbus, 87 on appliances at Mansfield, 84 on electric motors at Lima, an undisclosed number on transformers at Sharon, and 42 at Baltimore. But negotiations remained stalemated. Major obstacle to settlement apparently still is five-year term of contract sought by company. According to reports, order to hold fast against signing for five years comes from top former CIO leaders who are unhappy over GE five-year contract.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—AEC last week disclosed operating cost estimates for Duquesne Power's pressurized-water reactor atomic power plant at Shippingport **(1)** First core, designed to last 3,000 hr under full 60,000-kw power, will contain 11 to 12 tons of natural uranium, 50-60 kilograms of enriched uranium. **(2)** Power cost from first core will run 52 mills/kwhr, based on 15 mills for fixed charges ($45 million), 39 mills fuel charge ($18 million), and 3 mills operating cost, minus 5 mill "credit" gained in fuel reprocessing. **(3)** First core will be largely experimental, operating at 10% of capacity first year, 20% second year, 40% third year, 80% fourth year. **(4)** Second core of 90,000-kw capacity will have cost factor of 32 mills/kwhr; third 90,000-kw core will run at 14-15 mills/kwhr cost level.

Atomic Engineering—Combustion Engineering has purchased 530-acre site at Windsor, Conn., for new $5-million Nuclear Engineering and Development Center. It will contain facilities for complete design and development of nuclear power reactors, for construction of reactor cores, and for manufacture of related atomic fuel elements.

Pacific Northwest—In strongly worded briefs protesting action of public power groups seeking to block Mountain Sheep and Pleasant Valley hydro projects, Pacific Northwest Power hits out at Hells Canyon Association, one of intervenors. State PNP attorneys: "Hells Canyon Association is a sort of pyramided holding company organization, far removed from individual consumers of electricity who have little to say as to the activities of the organization."

New Financing—Dillon, Read & Co is offering 250,000 shares of Columbus & Southern Ohio Electric common at $31.75 a share to yield 5.04%.

Edison Shrine—Thomas A. Edison's West Orange, N. J., home and laboratory will become a national monument operated by the National Park Service. Edison's son and daughter, Charles Edison and Mrs John Eyre Sloane, last week presented the deed to the inventor's property to the government in a ceremony in the office of Interior Secretary Douglas McKay.

Expansion News—Southern California Edison plans $75-million steam electric generating station near Oxnard, Calif. First unit will have 200,000-kw capacity . . . Pacific G&E plans $21-million, 165,000-kw addition to its Hunters Point Plant.

ABOUT PEOPLE IN THE INDUSTRY

Spiking reports that Memphis' new steam plant would be divorced from TVA system, Edmund Orgill, mayor-elect of Memphis, said new plant would be as closely integrated as possible into TVA. "The plant can be owned by the people of Memphis and still be operated as closely as possible to the way it would have been if TVA had built at Fulton. . . There will be no consideration of employing the power system as a device for raising revenues for the city government" . . . and no special "cut rates" to attract industry.

Our rate of development of peaceful uses of atomic energy "will be determined by the rate of development of additional Fermis (Enrico Fermi) and by very little else as of the present moment," according to Dr Willard F. Libby, AEC Commissioner. "The real difficulty (to more rapid advancement) is the shortage of high-level technical manpower now. . . Our obvious course . . . is to increase the numbers and strength of our technical and scientific corps as rapidly as possible."

More News About People page 180

Coal Climbs as Power for Aluminum

- **Ohio Power signs long-term pact to supply 450,000 kw to Kaiser Aluminum**
- **Kaiser announces plans for $280-million expansion in Ohio River Valley**
- **Olin Mathieson and Reynolds Metals also consider coal as power source**

Coal is on the move as an electric power source for aluminum reduction. Ohio Power Co recently signed a long-term contract to provide 450,000 kw to Kaiser Aluminum & Chemical Corp's aluminum reduction operations at Ravenswood, W. Va.

News of the coal switch was coupled with Kaiser's announcement of a $280-million expansion program.

Largest single Kaiser project is a 220,000-ton aluminum reduction plant to be built at Ravenswood. The $120-million operation will be adjacent to a $96-million sheet and foil-rolling mill now under construction.

The significance of the power contract was commented on by Philip Sporn, president of American Gas & Electric Co, parent company of Ohio Power. He explained that the cost of gas and oil has increased while economically desirable hydro sites have diminished. Sporn continued:

"This brings coal and coal-based generation sharply into the picture. Where this coal lies on navigable water, and this is true in a large section of the Ohio Valley, it offers today an ideal combination of favorable economic factors for the development of large-scale, economical coal supplies required in large aluminum reduction operations.

"From a long-range viewpoint this is even more promising. This is due to the fact that, where the coal reserves are ample, it is possible in many cases to develop operations at sites where reserves of from 50 to 100 years can be made available. To this is added the fact that the technology of steam-electric generation is not only in a very highly advanced state in the U. S., but there is great promise of further advances."

An AG&E spokesman said the final cost of the power to Kaiser would be about four mills per kwhr. It will be delivered under a 30-year contract with two five-year options.

The Ravenswood operations will be about 50 miles from Ohio Power's Muskingum River Plant. The utility strip-mines coal nearby and brings it to the plant on a conveyor belt.

Last August Reynolds Metals Co announced plans for a 100,000-ton primary aluminum plant in Ohio River Valley. Reynolds will build a 300,000-kw station and utilize its own coal from adjacent deposits.

Another Contract in the Wind

Ohio Power has also discussed power with Olin Mathieson Corp, which holds an accelerated tax amortization certificate for a $74-million, 60,000-ton aluminum smelting plant. If an agreement is reached, this second contract could mark the resurgence of the coal-rich Upper Ohio River Valley, a region that aluminum companies deserted about 60 years ago.

Besides the Ravenswood plant Kaiser's expansion calls for a $60-million alumina plant at Gramercy, La., north of New Orleans. Its initial capacity of 500,000 tons a year can be quadrupled eventually. Plans provide for ground breaking at Ravenswood and Gramercy by April 1956.

Another $100 million in the Kaiser expansion will be spent on additional chemical facilities, two new extrusion plants, enlargement of the Newark, Ohio, electrical conductor plant, expansion of aluminum forging capacity and additions to foil-rolling capacity.

Negotiations for financing the program are now underway.

Kaiser Capacity Will Up 50%

The program is slated to boost Kaiser's basic aluminum metal producing capacity by more than 50% to 654,000 tons a year. Kaiser's Vice Pres D. A. Rhoades stated that the expansion will "establish the company as the nation's second largest aluminum producer by a substantial margin."

"Perhaps the most important factor of all," Rhoades emphasized, "is the assurance of an adequate long-range supply of economical power derived from coal."

Westinghouse Halves Top Pay

Declaring that it was "settling down for a long strike," Westinghouse Electric Corp recently put into action a program of management salary cuts, employee furloughs, and purchasing curtailments.

The girding-for-battle declaration coincided with a company statement that there has been "absolutely no progress in negotiations" aimed at ending the two-month strike of 45,000 members of the CIO International Union of Electrical Workers.

Elected officers of the company took an immediate 50% salary reduction, while other higher management personnel at strikebound plants were dealt a 40% pay cut.

Weekly furloughs on a rotation basis will be handed to engineers, scientists, and other management personnel, except those needed for "essential functions." All other non-management and non-professional workers will be furloughed except those "carrying on important work." Company spokesmen said that about 20,000 persons will be affected by the lay-offs.

The cutback was announced just two days after Westinghouse and IUE officials reached another stalemate in the labor parley. The company had proposed that the strikers return to the job under terms of the former contract while negotiations continued. The Union could walkout again if a settlement was not reached, the company provided.

IUE countered with its own proposal. The Union demanded that any wage increase agreed on during the talks be retroactive to September, the month that 45,000 workers stalked out of 30 Westinghouse plants. The company flatly rejected the counter offer.

STEVENS COUNTY PUD RECEIVES PAYMENT CHECK AND ITS FORMER EMPLOYEES SIGN WITH UTILITY AS . . .

Washington WP Takes Over PUD Properties

Final steps have been taken by Washington Water Power Co to buy out and start operating PUD properties in Stevens County, Wash. Action followed fast after a special election in which 72% of the voters had decided in favor of service by the utility over the PUD (EW, Dec. 5, p 8).

Alan Paine, general counsel for the utility, is shown above left as he presents a purchase money check to PUD Chairman Joe Garvey (l) in Colville. Above right Stanley Lickfold, former PUD groundman, is seen being signed up for the WWP payroll by Fred Campbell (l), salary evaluation and review coordinator.

By terms of the election Washington Water Power paid the PUD $2,905,000 for its properties in the county. The election marked the first time that voters had been given an opportunity in Washington to choose between PUD and private utility service since the PUD's were established in 1930.

Already about 2,300 new WWP customers are enjoying the utility's cheaper rates which are about half those of the PUD.

Kefauver Probes for Scandal in D-Y Contract

Sen Estes Kefauver (D-Tenn.) and his anti-monopoly subcommittee continued last week in their search for scandal in the abandoned Dixon-Yates power contract.

• The Senate anti-monopoly subcommittee questioned top Administration officials for hours, trying to prove their charge that government negotiators knew of the dual role played by Adolphe Wenzell, former First Boston Corp vice president who served simultaneously as a Budget Bureau consultant. Wenzell's part in pre-contract talks recently led the Atomic Energy Commission to declare there was a substantial question as to the contract's legality.

• The subcommittee tried to uncover information on White House talks on the contract.

• Sen William Langer (R-N. D.), a subcommittee member, urged further investigations aimed at determining how much, if any, funds were donated to the Republican campaign by principals involved in the contract during the national elections the year before.

Called in for questioning were Atomic Energy Commission Chairman Lewis Strauss, Budget Bureau Director Rowland Hughes, and Securities and Exchange Commission Chairman Ralph Demmler. Flanked by aides, they testified (1) they still believe the cancelled contract was sound, economical, and in the public interest, (2) there was no knowledge among Administration officials that Wenzell was playing "both sides", (3) no White House pressure had ever been exerted to ram the contract through, and (4) no attempt has been made to withhold evidence.

Strauss and Hughes refused repeatedly to answer when questioned concerning White House conferences on the contract. They claimed these conversations were privileged under the doctrine of separation of executive and legislative powers in the federal government. However, they freely discussed other meetings

(Continued on page 90)

Plant Design Changes Initiated

. . . in SCEGCO's plans for 550,000-kw steam project which will tap water flow to nearby hydro plant, have axial flow of steam

Plans incorporating important departures from conventional steam-plant design have been drafted for South Carolina Electric & Gas Co's 550,000-kw plant to be located below the utility's Saluda Dam and adjacent to its hydro station on Saluda River.

Because of the site selected, the new plant will be able to utilize water from Lake Murray, Saluda Dam's reservoir, without lowering the lake or reducing capability of the hydro plant, SCEGCO President S. C. McMeekin announced recently. In addition, axial-flow from turbine to condenser will provide more efficient operation.

Water for condensing will be taken from the penstock tunnels supplying power for the company's hydro station and will be returned, after use, to the lake. Head pressure, gained by tapping the penstocks, will be great enough to accomplish most of the water circulation thus minimizing pumping requirements.

Since the penstock tunnels are located near lake bottom, the water supply will remain at a constant temperature of 50-55F—ideal for condensing. Temperature of the water nearer the lake's surface rises to about 80 or 90 degrees in the summer months.

Efficiency in operation of the plant's first, cross-compound generating unit will be gained by permitting exhaust steam to leave the turbine in a straight line thereby reducing pressure lost enroute to the plant's condenser.

For economy of plant construction, a low-head boiler about 90 ft high, instead of the conventional 150 ft, will be installed.

Work on the new plant is scheduled to begin early next year. Installation of four 137,500-kw generators is planned eventually as demand warrants.

Kefauver Seeks Dixon-Yates Scandal

(Continued from page 89)

Hughes turned over to the subcommittee every Budget Bureau notation concerning Wenzell and the contract, excluding those which referred to White House discussions. In addition, he declared that Budget Bureau officials never regarded Wenzell as a principal during negotiations leading up to the contract's signing.

Strauss, on the other hand, called Wenzell "the principal advisor to the government." He said he knew the First Boston vice president was called in as an outside expert but that he had no direct knowledge during the negotiations of the banker's standing as an official government consultant at the Bureau of the Budget.

Reminded by Subcommittee Chairman Estes Kefauver (D-Tenn.) that Wenzell had testified he had told Strauss he represented both the government and First Boston, Strauss said, "Wenzell's memory was vague, as shown by the record." But he added, "He may have told me; I have no recollection of it."

Wenzell's role, Hughes stated, was "to report on market conditions" to help the government determine salability of Dixon-Yates bonds and to arrive at power, interest rates.

Hughes said, "We knew he (Wenzell) was from First Boston. But we did not know of any conflict. Neither does AEC, as shown by the opinion of its general counsel. The courts will have to work that out."

Hughes said he had been questioned by Wenzell as to whether the banker's activities would "shut out" First Boston from possible participation in financing the contract then proposed. As deputy director of the Budget Bureau, Hughes said, he advised Wenzell to check this out with First Boston, then report back to Bureau Director Joseph Dodge. When he did this, Hughes testified, Wenzell was told by Dodge to complete his job of the moment, then resign from the government. And Wenzell resigned several months later.

As the hearings ended, it became clear that the Atomic Energy Commission is preparing for a court fight to keep from reimbursing the Dixon-Yates firm for the $2- to $3-million it spent in preparing a site for the 600,000-kw steam plant it would build to fulfill the contract.

It also is clear that Congress will continue to investigate. Senator Langer, a public power advocate, introduced several resolutions calling for investigation of election donations by officers in the Dixon-Yates firm. He asked that former Republican and Democratic National Chairmen Arthur Summerfield and Stephen Mitchell, Presidential Assistant Sherman Adams, and officials of the National Association of Electric Utilities be subpoenaed for questioning on the matter.

Idaho Power Speeds NW Tie

. . . with deadline for completion set at Xmas eve; 230-kv link with NW Power Pool will also provide tie for Snake's Brownlee

The day before Christmas has been set as the deadline for Idaho Power Co's 47-mi high voltage transmission line between Baker and La Grande, Ore., which is now almost complete (EW, Nov. 28, p 58).

The 230-kv line and Baker substation—together costing $2.5 million—will provide a second Idaho Power link with the five-state system comprising the Northwest Power Pool. The present link with the power pool runs through eastern Idaho and Montana.

The Baker terminal for the new line also will tie in the Brownlee plant of the company's newly launched Hells Canyon project. Aerial surveys for a $1.1-million, 53-mi transmission line from the substation to the Brownlee plant are in progress. It will be the first of five high voltage lines which will connect the Brownlee plant to the company's service area and the power pool.

From 85 to 100 men of the power company's mobile crew, working in stormy weather through mountainous terrain, have dug all the post holes. Most of them had to be blasted out of solid rock to a depth of 8 to 11 ft.

All pole-line structures have been set. These were put in during a three week continuous effort requiring the crews to work 10 hours a day, six days a week.

Thirty miles of conductor for the three-line circuits have been strung. Nearly a million pounds of high voltage conductor will be in place by the time the project is completed.

Company Foreman C. J. Scholes says the Dec. 24 deadline will be met in spite of heavy snow and bitter cold. The mercury recently plunged below zero to set a new record for low temperatures this early in the Blue Mountain winter.

The inter-tie that will be afforded when the line is "alive" will greatly increase transmission capacity for transfer of power between east and west groups of the power pool.

One span of the Baker-to-La Grande line crosses a canyon through which a major highway runs. This single span measures 2,686 ft.

The remaining work on the Baker-to-La Grande line is concentrated in the La Grande area.

The inter-tie will meet varying load and supply conditions in the power pool. One feature of the Idaho Power-Bonneville Power Administration contract is that power will be exchanged when either has a usable surplus and the other needs it.

NEW 240,000-KW DRAKELOW A POWER STATION

CONTROL CENTER HANDLES PLANT OPERATIONS

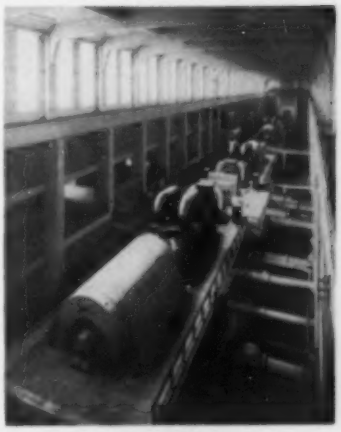
Britain Opens 240,000-kw Steam Plant

Great Britain's 240,000-kw Drakelow A Power Station recently spun into operation with opening ceremonies by officials of the Central Electricity Authority. Work on Drakelow B at the same site has begun and combined output of the two plants will be 720,000 kw.

Centrally located controls load Drakelow A's four 60,000-kw generators, operate the 132-kv switchyard and main circuits of the auxiliary supply system, and drive the river water pumps which are some distance from the plant. Provision has been made for additions to the central control room when Drakelow B has been completed.

Generating units at the plant are set in line with each pair having steam ends adjacent. Each unit has its own surface condensers and feed-water heating system.

The 746-acre site for the Drakelow Plants is northeast of Birmingham, near Burton-on-Trent. Proximity of coal fields and rail connections were considered in selecting the site. And facilities have been installed to receive coal shipments by both truck and railroad.



DRAKELOW'S TURBINE ROOM

Are Wiring Certification Standards Too High?

• YES, say some utility men who would like to see them simplified and a broad "umbrella" for certification established

• NO, say NAWB adherents who fear it would mean scrapping of a long-established program and loss of contractor-manufacturer support

There's pressure afoot to simplify the industry's wiring certification standards. Here's what is happening:

• Some utility men, disturbed by slow progress of Adequate Wiring certification programs, are calling for a reorientation.

• On the other hand, proponents of the present certification setup say the changes being considered would mean a lowering of wiring standards and the scuttling of a carefully built program.

The issue is far from settled. Certain utility sales executives who would like to see some changes made haven't yet sold their case, but prospects for at least a reconsideration appear likely. Those favoring simplification expect to put their case before industry representatives before the end of the year. The National Adequate Wiring Bureau and its newly established Task Committee of Certification Procedures will take a look at the problem early in January.

Contend AW Is Failing Goal

Those for changes contend that the present Adequate Wiring certification program is failing in its most important goal—that of making the public aware of the value of good, safe, adequate wiring. They point out that less than 20,000 homes of the 1.4 million being built this year will receive "Adequate Wiring Certificates." As a result, they argue, few home builders or buyers seem to care or be particularly aware of the Adequate Wiring promotion.

Among the reasons they give for this low certification is that not enough of the industry is really pushing it—mainly because present standards are too rigid and do not provide a wide enough latitude. They hold that some companies find existing AW certification is not realistic when applied to their own local situations, and so they abandon them in favor of standards of their own. Thus, say these proponents of change, we end up with a potpourri of conditions, a variety of wiring symbols and slogans, and a diluted national Adequate Wiring program.

Bigger Umbrella Needed

Their solution: Set up a broader certification "umbrella" under which everyone can operate. Take away some of the "frills" goes their argument, and we could certify half the homes. That would go a long way towards steaming up public awareness and making buyers check wiring jobs before they buy.

"After all," says one member of the side for change, "what do you mean by adequate wiring. Do you mean adequate for today? For tomorrow? For ten years from now? The most you can expect under any program is to get wiring adequate for present needs. In most locations you can get that with a 100-amp service and 10 to 12 circuit panels. That'll give you your appliance circuits and plenty of entrance capacity for most present jobs. It's enough for the present to make the entrance requirement.

"The other 'frill' standards such as spacing of convenience outlets, optional provisions calling for closet and outside lights, and a second inspection may have relatively little connection with adequate wiring. These so-called 'frills' add to the inspection costs for Adequate Wiring Certificates. Present costs are around $20 to $25. If they were cut out, the inspection fees might be brought down to $5 each."

Another member of the simplification camp goes further. "Let's eliminate the reference to adequacy altogether," says he. "Let's promote CERTIFIED wiring instead of certified ADEQUATE wiring. And then let the standards of certification seek their own levels according to local conditions."

What Happens To NAWB?

What would happen to the present National Adequate Wiring Bureau under such a set up? "Perhaps it could become simply the National Wiring Bureau and sponsor this industry-wide Certified Wiring program."

But those who are against a change have some arguments, too.

They wonder where the enthusiastic critics of today have been all these years when the AW program has been pretty tough going. Shall the present program be torn asunder because a lot of Johnny-Come-Latelies are now ready to cash in on a campaign that is just beginning to pay off?

"We've spent a lot of money selling the AW idea and in putting over the term 'adequate,'" they point out.

"Why should we toss all this down the drain now? And utilities, what with the money and effort they have put into setting up bureaus and awarding certificates, would be among the heaviest losers.

Customer Would Lose, Too

"Think about the customer who would purchase a so-called 'certified' home and then would discover he still must resort to the 'octopus' or else make a considerable investment in wiring improvements. Wouldn't the certificate eventually lose all of its value as a sales tool?"

Furthermore, they ask, is it wise to lower standards at a time when wiring at its best is needed most? If anything, the time is coming when standards will have to be raised again. Besides, the number of homes certified is a little misleading, maintains the AW adherents. Local bureaus do not base results on "number of certificates" but rather on number of increases in service entrance capacity, additional circuits, and outlets installed, etc. In such areas, it is found that a good many projects "just miss" certification requirements, but nevertheless contain greatly improved wiring as a result of bureau efforts.

Two Inspections Not Mandatory

As for certified jobs requiring two inspections, the AW people point out that it is not mandatory. It is recommended only to make certain that the actual wiring installation complies with the standards of adequacy.

What is more, applications for licenses to operate the certified Adequate Wiring program are coming in at a faster rate than ever before in history. And by far the majority of these new bureaus, they say, are adopting the Residential Wiring Handbook's standards with a minimum of modification.

"Finally," they say, "wouldn't such a move to 'simplification' threaten the loss of contractor and manufacturer support? The electrical contractor is the key man in any wiring sale. The present high standards represent a choice market for his services. How would he react to a program which would take away some of his most profitable business?

And so the arguments go. Observers see the controversy gaining momentum and utilities, by virtue of their position and interest will be right in the middle of it.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING OCTOBER

State	Utility	Plant	Fuel	Capacity
Me.	Central Maine Power Co	Mason	S	30,000
Conn.	Connecticut Light & Power Co	Shepaug	H	37,250
N. Y.	New York State Electric & Gas Corp	Milliken	S	108,000
Ohio	Ohio Edison Co	R. E. Burger	S	270,000
Ind.	Crawfordsville Electric Light & Power Plant	Crawfordsville	S	11,500
Ind.	Indiana-Kentucky Electric Corp	Clifty Creek	S	180,000
Mich.	Upper Peninsula Generating Co	Presque Isle	S	22,000
Iowa	Iowa Electric Light & Power Co	Guthrie Center	IC	1,000
Iowa	Manilla Municipal Service Dept	Manilla	IC	645
Kan.	Kingman Municipal Light & Power Dept	Kingman	IC	1,420
Kan.	Central Kansas Power Co	Colby	S	6,000
N. C.	Virginia Electric & Power Co	Roanoke Rapids	H	25,000
Ga.	Georgia Power Co	Hammond	S	100,000
Ark.	U. S. Army Engineers	Blakely Mountain	H	37,500
La.	Franklin Municipal Plant	Franklin	IC	1,400
Tex.	West Texas Utilities Co	Marfa	IC	1,000
Tex.	West Texas Utilities Co	Paint Creek	S	30,000
Ore.	U. S. Army Engineers	McNary	H	70,000
Calif.	Bureau of Reclamation	Folsom	H	54,000
Calif.	California Electric Power Co	Highgrove	S	40,000
Calif.	Pacific Gas & Electric Co	Pit No. 4	H	90,000
Calif.	Pacific Gas & Electric Co	Morro Bay	S	169,118

RETIREMENTS

Ill.	Commonwealth Edison Co	Crawford	S	51,000
Mich.	Consumers Power Co	Tecumseh	H	300
Iowa	Manilla Municipal Service Dept	Manilla	IC	160
Iowa	Iowa Public Service Co	Kellogg	S	2,500
Iowa	Interstate Power Co	Clinton	S	5,700
Neb.	Blair Dept of Utilities	Blair	IC	430
Kan.	Kingman Municipal Light & Power Dept	Kingman	IC	300
Okla.	Public Service Co of Oklahoma	Elk City 1	IC	436
Okla.	Public Service Co of Oklahoma	Elk City 2	IC	336
Okla.	Public Service Co of Oklahoma	Erick	IC	292
Okla.	Public Service Co of Oklahoma	Sayre	IC	160
Okla.	Public Service Co of Oklahoma	Stigler	IC	120
Okla.	Public Service Co of Oklahoma	Weatherford	IC	295
Idaho	Idaho Power Co	Salmon Hydro	H	560
Idaho	Idaho Power Co	Salmon Diesel	IC	72

U. S.	Hydro	Steam	IC	Total
Added	313,750	966,618	5,465	1,285,833
Retired	860	59,200	2,601	62,661
Adjustments Plus	.....	.....	891	891
Adjustments Minus	.....	.....	.....	.....
Net Change	312,890	907,418	3,755	1,224,063

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of November 1—Hydro, 24,745,550 kw; Steam, 85,031,495 kw; IC, 2,356,737 kw; Total, 112,133,782 kw.

Echo Park Dam Struck from Colorado Project

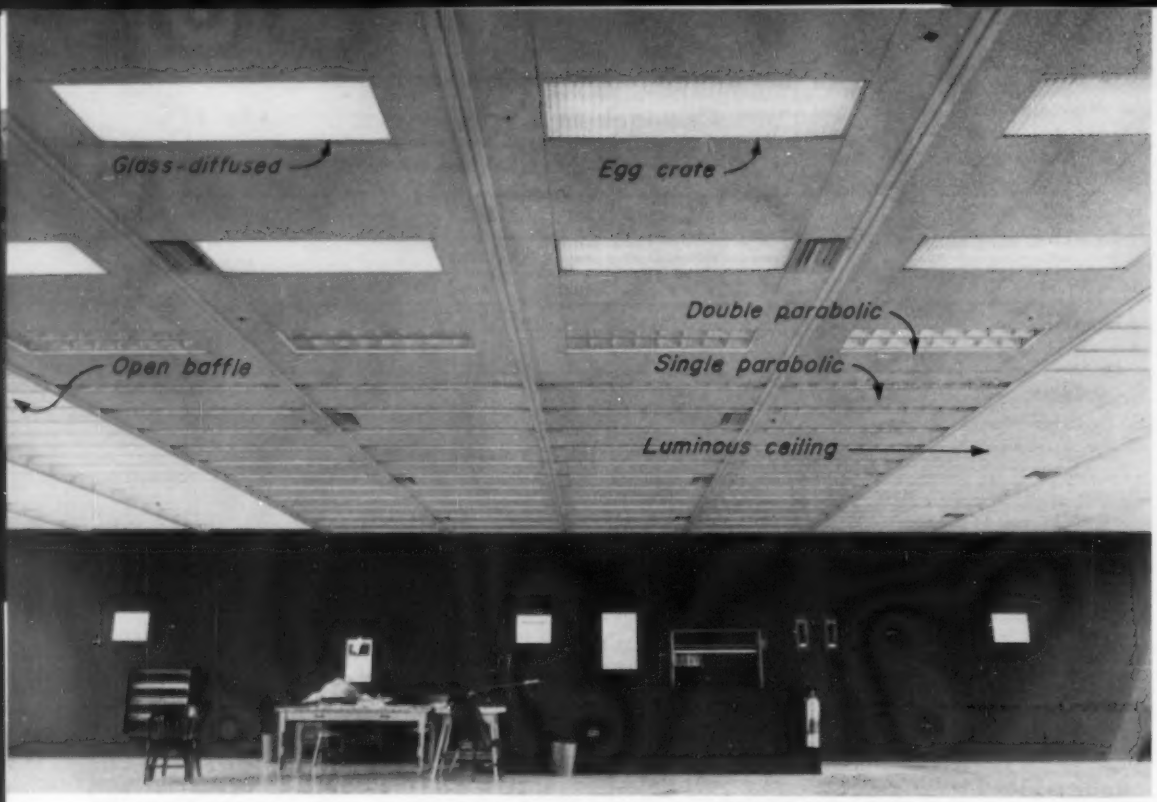
The Administration abandoned Echo Park Dam in the hope of getting an Upper Colorado River storage bill passed by Congress next session.

Interior Secretary Douglas McKay last year stood the Administration solidly behind Echo Park, insisting on the big dam as an essential feature of Eisenhower's one large federal reclamation project.

Recently, McKay said Interior would "acquiese" in an agreement by 11 Colorado-area Senators to let Echo Park go by the board, pushing for completion of Congressional action on a bill authorizing other features of the $1.5-billion storage plan. McKay said Interior would consider support of substitute dams it has heretofore opposed in order to fill in the gap left in the river development plan if Congress passes the Echo Park-less bill.

NEES Plans New Unit

Construction of a 140,000-kw, $20-million unit is planned by New England Electric System as an addition to the system's Salem Harbor Station. Another NEES 150,000-kw unit is now nearing completion on the upper Connecticut River.



THIS IS THE MOCKUP. NOTE FINISHED CEILING WHICH HELPED CONTRACTORS BID ACCURATELY ON CONSTRUCTION

Lighting Schemes Pretested in Mockup

INDUSTRIAL Design

More than 25 variations on 3 basic schemes were tried in detail to help engineers pick most suitable lighting for new building

FELIX GRAHAM, Chief of Electrical Dept, Syska & Hennessy, Inc, New York, N. Y.

An insurance company is using a full-scale mockup to find the best lighting scheme, flooring materials, and furniture arrangements for its new home office now being built at Bloomfield, Conn., near Hartford.

The Connecticut General Life Insurance Co commissioned its architects, Skidmore, Owings, & Merril, and the Turner Construction Co of New York to design and build this two-story model of part of its new $10-million office building.

Three lighting schemes were tried out in exact detail and with all the trimmings of a finished installation. Each basic scheme served only as a theme for engineering variations, and at least 25 lighting arrangements were tried in all.

As a result, the new office building will get a lighting system that appears to be most suitable from both engineering and esthetic points of view. The lighting system selected—an open baffled ceiling—probably has never been used before in this form. It was designed jointly by the architects and Syska & Hennessy, Inc, the mechanical and electrical engineers on the project.

Contract Bids Were Lower

When the experimenting was over, electric contractors could examine the mockup closely and bid more accurately on the actual job. The architects and owners feel that the bids were lower by thousands of dollars—and more precise—than they would have been if the contractors had only blueprints and imaginations with which to work.

The mockup has enabled the builders, contractors, and designers actually to try out different lighting schemes suggested for the actual office. This has helped settle differences of opinion and has given designers, builders, and owners confidence in the design that the finished building will have.

Before describing the lighting experiments in detail, it seems appropriate to set down a few remarks about the building itself and the mockup.

Connecticut General's new home office will be located in rolling, wooded land five miles northwest of downtown Hartford. It will have a three-story work area and a four-story wing which will house the public lobby and some special departments. A one-story dining room, seating 800 persons, will overhang a reflecting pool.

To "bring inside" part of the natural beauty of its surroundings, the

HOUSING THE MOCKUP, THIS FULL-SCALE "PILOT" ALSO HELPED BUILDERS FIND BEST CONSTRUCTION MATERIALS

building will have transparent walls to permit expansive vistas. These walls will be made of heat-absorbing glass. The building is characterized inside by its large open ceilings, 470 by 320 ft. The size and nature of this large ceiling area played major roles in the selection of the proper type of lighting.

The mockup is a full-scale model of a typical 60 x 72-ft clerical area that will be in the main building. The mockup represents about 1% of the total 500,000 sq ft of office space. Its front simulates the glass facade of the proposed building, and the opposite glass wall, the side overlooking a garden court. (The main building has four interior garden quadrangles.)

A temporary building, the mockup has a steel frame consisting of three heavy steel girders spanning three steel columns. The walls are of plywood. The second floor is the experimental area.

25 Lighting Schemes Tried

In this experimental area open baffle, luminous, and troffer types of lighting were explored in 25 variations.

- Baffled lights in 2 x 6-ft modules were tried in acoustically treated ceilings, with baffles untreated. Baffled lights in 2 x 6-ft modules were tried with the baffles acoustically treated, but the ceiling untreated. And a 3 x 6-ft and a 3 x 3-ft module were tried.
- Bare lamps were tried also—430 ma lamps in the 3 x 6-ft and 3 x 3-ft modules, and 200 ma and 120 ma lamps in the 2 x 6-ft modules. Eight different methods of diffusing or shielding these bare lamps were explored.
- Luminous ceilings were tried in five variations and with two colors of lamps (warm and cool):

1. Double plastic luminaires, without baffles.
2. Single plastic standard corrugated, with baffles.
3. Single plastic closely corrugated, with baffles.
4. Square molded panels, glass pattern up.
5. Square molded panels, glass pattern down.

- A troffered ceiling was tried using individual 24- x 48-in. double parabolic aluminum luminaires. Three other troffered ceilings consisted of 24 x 48-in. individual luminaires with eggcrate, Albalite glass, and Corning No. 70 glass diffusers, respectively. Another variation consisted of 6-ft-long single parabolic aluminum luminaires arranged in continuous lines.

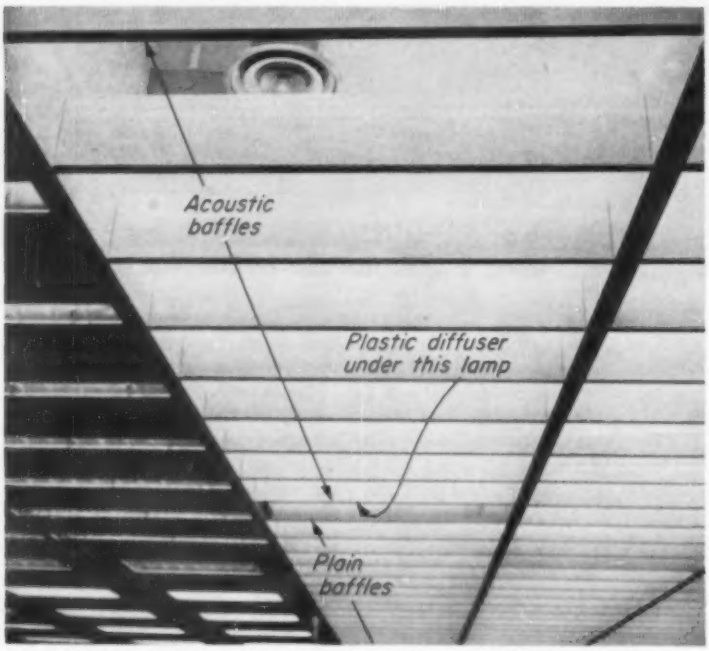
Consultants made quantitative studies of the lighting and acoustical efficiencies of the various ceiling systems and reported their findings to the building team. (See accompanying chart which covers two systems.) During the test period, committee meetings were held at the mockup to thrash out differences of opinion. This technique sometimes paid off in such comments as, "Now that I've lived with this ceiling, I've gotten to like it."

'Right' Ceiling Had to Be Found

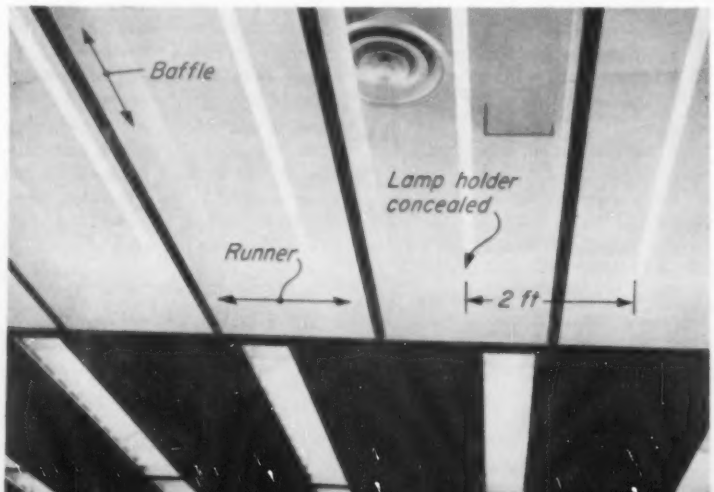
Finding the right ceiling was important from both the mechanical and esthetic standpoints. Mechanically the ceiling had to be equipped most efficiently with lights, loudspeakers, conduits, fire sprinklers, air conditioning ducts, and sound absorbing materials. It also had to hold anchors for the upper ends of vertical partition posts. Esthetically it had to reflect the spirit of airy openness imparted by the large glass windows and open indoor construction.

After weeks of deliberation the building committee settled upon the open baffled system. The system

APPEARANCE as well as foot-candle readings helped determine proper lighting for this building. Rural setting, employee comfort, building motif were factors



OPEN BAFFLE construction won final vote. Baffles carry fixture wiring. Runners hold ballasts, sockets, and supply circuits. This system helps create illusion of daylight streaming through ceiling. Cool-toned tubes were chosen for actual job



chosen consists of 2 x 6-ft modules in which the baffles are acoustically treated but the ceiling is not. Fluorescent tubes drawing 120 ma were chosen instead of higher current tubes because of the two-foot spacing. It was felt that this would be economical. To use 200 or 430 ma equipment meant generating more light than was required and paying for it year after year. From the designer's point of view, this open baffled ceiling also scored well on costs, light quantity, noise reduction, and anticipated maintenance.

Unit Substations to Be Used

When the new building is finished, it will be served from a number of unit-type substations in its basement. Lighting will be on 277/480-Y circuits. Office machines will take power from other circuits at 120/208-v carried through wires in a cellular metal floor. The inside walls all are of glass, and there will be no columns suitable for wall switches; so lights will be controlled from panels on each floor. Lights will be fed through conduit buried in floor near the metal cells.

The cellular metal floor provides 12 cells per six linear feet. The electric, telephone, and signals cables occupy the first three cells, respectively, in what might be considered an "electric module." However, should it be desirable in the future to intensify power, telephone, or inter-office communications circuits, provisions have been made to do this easily. Knockout fixtures in the sixth, seventh, and eighth cells, respectively, already are installed and can be utilized to give these services on three-foot centers. This will help keep costs down if such expansion is required.

Mockup Tests Flooring, Too

Even though the mockup has served its purpose as far as lighting is concerned, the mockup still bustles with activity. Floor coverings currently are under study. Interior design schemes for clerical areas and private offices also are being worked out. Colors and tones that harmonize best with the lighting conditions are being sought out; the use of movable partitions to divide work areas also is being tested; styles of office furnishings and types of window shadings are being tried.

The ground floor of the mockup is serving as storage space for construction materials, fixtures, and tools.

Moreover, it is used for testing types of concrete forms and glazed brickwork being considered for the final structure. However amenities in the replica are limited to a simple hot air heating system (boiler on ground floor) and two telephones.

The architects and builders previously had applied mockup replicas to advantage. The insurance company thought that a mockup could be used profitably in this case too. Company officials felt that the new glass walled horizontal office building should be as soundly designed as possible. They felt that a mockup would help prove good and novel design features. To date they have not been disappointed. The mockup already has paid off handsomely in a good lighting system for Connecticut General's new office.

Typical Comparison of Tested Lighting Schemes

To give the reader an idea of the type of analysis made in the mockup, presented here is a comparison of two of the 25 variations of lighting systems tested experimentally.

Factor	Open Baffle Ceiling	Mineral Tile Ceiling with 2x4 Troffer	Comment
1. Quantity of Light	55 ft-c	45 ft-c	Figures adjusted for maintained value
2. Quality of Light			
A. % of people comfortable, considering ceiling light alone	97% Crosswise 80% Lengthwise	97% Crosswise 93% Lengthwise	———
B. Effect of ambient light on 2A (caused by window area)	Comfort increases	Comfort decreases	Brightness contrast between outside and baffled ceiling is only about 1/10 of contrast between outside and solid ceiling
C. Reflected glare on shiny surfaces	Moderate	Pronounced	Open baffle ceiling presents less reflected glare than troffered ceiling
D. Absence of shadow	Excellent	Good	———
3. Acoustical properties	70–80 Noise Reduction Coefficient (per Newman)	70–80 N.R.C.	———
4. Maintenance			
A. Relamping	Very easy, no fixtures to remove	Easy	———
B. Cleaning	Very easy, no fixtures to wash; use vacuum cleaner	Easy. However, troffers must be washed. Ceiling around air diffusers requires frequent cleaning	———
C. Painting	Easy to get at, but extensive areas to be painted	Very easy, relatively small area to be painted	———
5. Suitability for installation in large or small areas	Well suited for large open areas and easily adapted to small areas	Equally well suited to both large and small areas	———
6. Durability	Excellent	Good	———
7. Interference with diffusers, sprinklers, etc.	Minimum	Moderate	———
8. Operating Costs			
A. Power consumption	2.80 w/sq ft	2.69 w/sq ft	Difference of $1,400 per year in favor of troffered ceiling but 10 ft-c less illumination
B. Relamping			
Three 6-ft tubes	$4.41	———	
Two 4-ft tubes	———	$1.38	———
C. Effect on Air Conditioning	Minimum	Minimum	———
9. Ratio of Initial Cost (on basis of 100, and including all factors involved in ceiling construction)	About 90	100	———
10. Compatibility of lighting scheme with building design	Excellent	Moderately good	Architects advise that open baffle ceiling is in character with the building design as a whole in regard to scale, airiness and general effect
11. Stiffness as partition support	Good	Fair	If partitions are supported by posts tied to the ceiling, some local stiffening of Mineral Tile might be necessary
12. Flexibility as to varying quantity of illumination	To give 80 ft-c: replace ballasts	To give 90 ft-c: double number of troffers, add framing, remove Mineral Tile	———

TRANSMISSION
Maintenance

By Measuring the Radiated Heat Dissipated by Transmission Lines, PSE&G Has a Method Whereby . . .

Bad Splices Are Easily Detected

R. M. HAVOURD, Engineer, Electric Distribution Department, Public Service Electric & Gas Co, Newark, N. J.

Use of a bolometer or infra-red pyrometer has resulted in easy, fast, and accurate detection of defective overhead conductor splices. Although it is a relatively expensive instrument, the bolometer has more than paid for itself by anticipating many splice failures.

A total of 694 splices have been tested since Public Service started its program about a year ago. Of these, 79 showed temperature rises above ambient of 5 to 140C.

The bolometer detects and measures minute quantities of heat radiated by an object. Fundamentally it consists of a mirror which collects infra-red rays and focuses them on a heat sensitive element which in turn causes a minute electrical current to flow. This current is then multiplied by an electronic amplifier and its magnitude read on a microammeter. With the aid of calibration curves this reading is converted to temperature.

The instrument itself, a tripod on which to mount it, and a battery case are the three components of the field assembly. Total weight is 40 lb.

Adapted from a paper presented by the author before the Transmission and Distribution Committee of Edison Electric Institute at New Orleans, La., Sept 30, 1955.

The instrument consists of an elliptically ground mirror, 6 in. in diam, mounted in and near the rear end of a metal tube. Mounted inside and near the front end of this tube is a thermistor on which the infra-red rays are focused by the mirror. Encircling the thermistor is a motor-driven metal cylinder in which there are three holes in line with the thermistor. This cylinder revolves at 900 rpm, thus interrupting the heat rays 2,700 times a minute, and providing a chopped impulse.

How Bolometer Operates

On top of the large tube is a telescope having two vertical and two horizontal crosshairs for centering the bolometer field on the splice. In the tube's rear end is an electronic amplifier for amplifying the chopped current produced by the thermistor and revolving cylinder. On the rear end of the tube are a microammeter for measuring the magnitude of the current and four controls.

Directly above the meter is a focusing control. It moves the thermistor back and forth so that it can be placed at the exact focus of the mirror regardless of distance from the splice. It also acts as a range finder having a footage calibration around its periphery. This aids in the selection of the proper calibration curve. Top switch to the left of the meter has six positions: a normal operating position, four positions used in checking the various battery voltages, and one which is not used. Bottom switch to the left of meter is an "Off-On" switch. To the right of meter is a gain switch for controlling bolometer sensitivity.

Measurement is obtained by a bridge circuit. In one leg of the bridge is the thermistor on which the infra-red rays from the splice are focused and in another a thermistor which is exposed to ambient temperature. Unbalanced current flow is amplified so that its magnitude can be read on the microammeter.

Device is exceedingly easy to use, and once on location only a few minutes are required to take a reading. If possible, the bolometer is set up at right angle to the splice and as near to it as possible. Readings can be taken, however, at distances up to 150 ft. Focusing knob is then set at estimated distance to the splice and the instrument's field centered on the splice by means of the cross hairs in the sighting telescope. As a splice one inch in diameter by 10 in. long at 80 ft will cover the field of the instrument, there is no problem in making the horizontal sighting on a 795 MCM ACSR splice which is approximately two in. in diameter by 32 in. long.

Vertical sighting, however, is a little more critical but by no means difficult. After the instrument is centered on

the splice by means of the sighting telescope, the vertical adjustment tangent screw is turned slowly in one direction until an increased deflection of the meter is observed. This is sky radiation which is cold and a lower temperature than ambient. While observing the meter, the tangent screw is moved in the other direction to bring the splice back into the field and then continued on to the sky on the other side of the splice.

Final adjustment is then made for a maximum reading between the two sky readings. No sky radiation will be present in field of instrument. During the preliminary adjustments the gain is set at a low sensitivity and later increased for maximum scale deflection.

Data Needed for Reading

Bolometer is now properly centered on splice, but maximum deflection, and therefore the proper temperature, most probably is not being indicated. To obtain the maximum reading and the proper temperature indication, thermistor which receives the infrared rays from the splice must be moved to exact focus of the mirror by means of the focusing knob. Proper focus is indicated by maximum reading. After this is done, the microammeter is read. In addition, the distance from the splice is read from the focusing knob and the gain position is noted. Knowing these three quantities, the temperature can be read from a calibration curve.

Calibration curves are made in the laboratory for various distances up to 150 ft. They are made by sighting bolometer on an actual splice, removed from the lines, placed at the various distances for which curves are to be plotted. A splice removed from lines is used so that calibration specimen will be of the proper color as amount of heat radiated by a body depends on its surface color. If calibration were made on a new shiny joint, calibration curves would be incorrect when used with readings obtained from a full oxidized surface. Splice is then heated with a blow torch and temperatures obtained from thermocouple readings are plotted against the bolometer readings.

While the manufacturer states the bolometer is accurate to within ±5C, checks made with thermocouples on defective splices removed from transmission lines have indicated that the accuracy is probably somewhat greater.

If a splice indicates a very low rise, say 5 to 10C, it is possible that the line is carrying a high current; and it is perfectly normal for the splice to show a rise. To verify this, the bolometer is sighted on the conductor to determine whether it also shows a rise. If the conductor shows no rise, the splice is defective. Any splice which is perfect will always have a smaller temperature rise than the conductor as it has a greater radiating surface. Because it is more than likely that splices which show temperature rises greater than those of the associated conductors will deteriorate further with time, all such splices are removed as time permits.

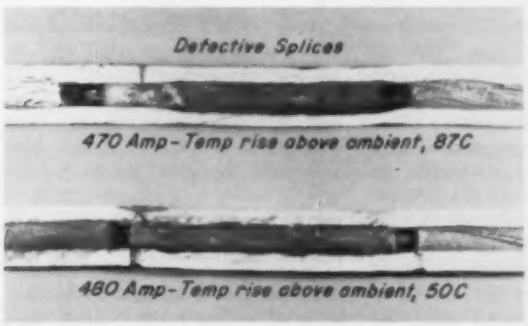
Lines Must Carry 400 Amp

It is possible that if checks are made on splices at a time when they are carrying a light load or when the ambient temperature is low, a defective one may not show a temperature rise. To preclude this possibility, testing is performed when lines are carrying at least 400 amp and the ambient temperature is at least 40F. If certain lines normally carry less than 400

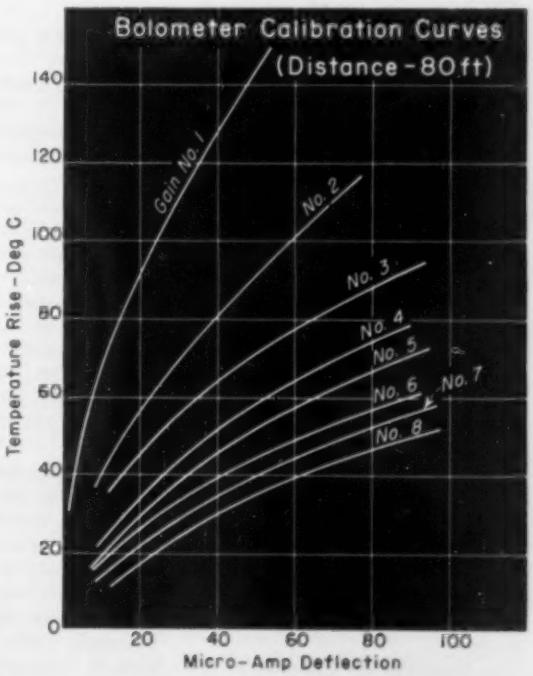
(*Continued on page* 188)

Summary of Bad 132-kv Splices

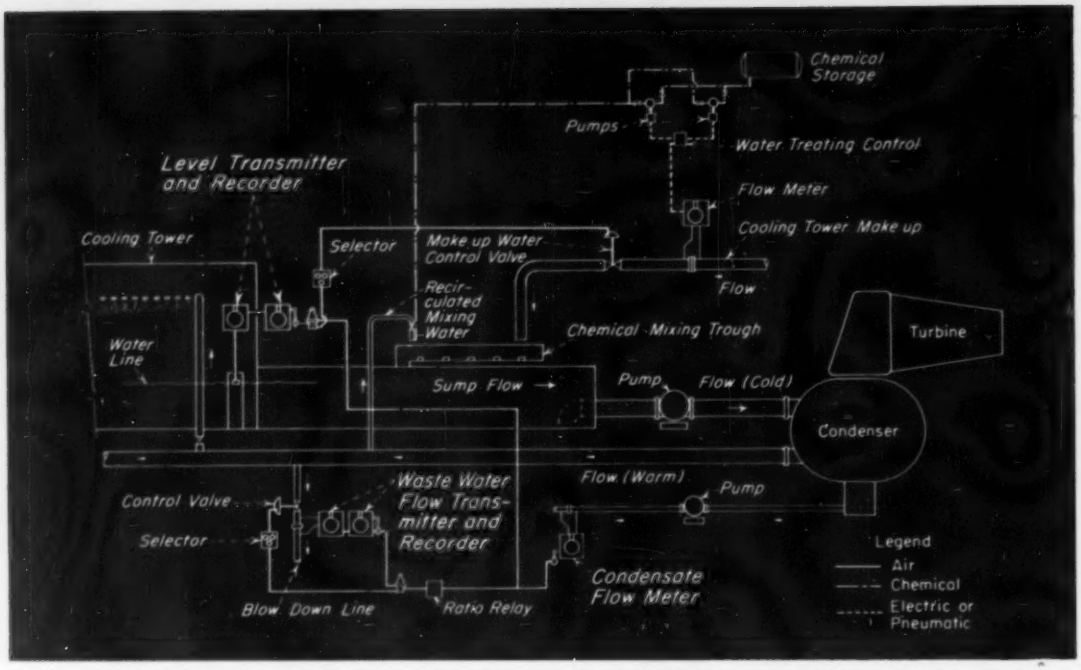
Temp Rise Above Ambient—Deg C	No. of splices
5–25	56
30–50	14
55–75	3
80–100	3
105–140	3
Total	79



ALL SPLICES with a rise above ambient of 25C or more are replaced as soon as possible and all others showing a rise greater than the associated conductor when time permits



KNOWING DISTANCE to the splice, position of the gain control knob, and the microamp reading enables the operator to read temperature rise above ambient from the curves



SCHEME AUTOMATICALLY REGULATES FLOW AND TREATMENT OF MAKEUP WATER TO COOLING TOWER, SPRAY POND

Automation Cuts Cooling Tower Costs

GENERATION
Operation-Maintenance

New system pioneered by Southwestern Public Service Co controls scale and corrosion and limits the use of water and chemicals

E. W. ROBINSON, Chief Engineer, Generation Plant Design, Southwestern Public Service Co, Amarillo, Texas

An automatic control system, based on a principle new to the industry, has minimized Southwestern Public Service Co's costs of operating and maintaining cooling towers and spray ponds. The system controls scale and/or corrosion, limits excessive water consumption and use of water-treating chemicals, and reduces operational manhours.

This automatic control system holds down costs by:

1. Maintaining the correct water level in the basin under all load conditions.

2. Keeping the pH and concentration of dissolved solids within close limits.

3. Governing the treatment of raw water makeup.

Although numerous schemes have been devised to perform these functions, Southwestern believes the principle of its control system is the first truly automatic one. This principle uses the condenser heat load, or a very close approximation, to originate the initial impulse setting all control functions in motion.

The automatic control system will be applied in the cooling cycles of seven generating units, ranging from 20 to 100 Mw. Station operators report favorably on the six systems in operation. The seventh is under construction.

As the continually growing industry inevitably will use more cooling towers and spray ponds, station operators must understand the problems of maintaining satisfactory condenser cooling water through manual control and treatment. Poor control of water treatment results in the deposit of scale in condenser tubes which adversely affects condenser performance. Lower vacuums caused by fouled tubes can be quite costly.

For example, a 100-Mw, 1,250-psi, 950F unit operating at 60% annual plant factor on 20¢ per million Btu fuel would consume about $4,200 per year in excess fuel for each 0.1-in. vacuum lost through condenser tube fouling. Correction through acidizing the condenser or other methods of scale removal often cost about $6 per 100 sq ft of tube surface.

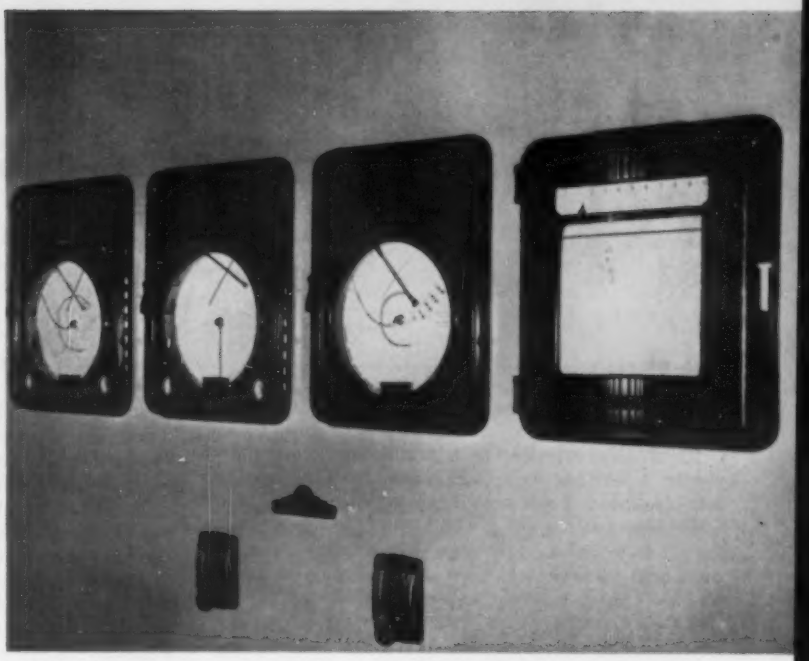
Poor water treatment control also can result in corrosion requiring large maintenance costs. Such outlays are usually difficult to determine; they occur over a long period and are a function of many variables. Usually both scale and corrosion can be reduced greatly through very close control of the correct water treatment.

Generally the results obtained by manual operation are poor. The effectiveness of the sulphuric acid treatment of cooling tower makeup water depends upon close control of the acid feed. Too much acid gives corrosive water, too little a scale deposit.

Where water is plentiful and cheap, usually little attention is given to its conservation. The possibility of wasting water through excessive tower blowdown is always present when concentration of dissolved solids in the condenser water is controlled manually.

Concentrations tolerable in condenser cooling water depend upon the quantity and character of dissolved minerals in the raw water supply and upon the type of water treatment employed. As perfect manual maintenance of the needed concentration is almost impossible, a cautious operator usually bleeds more water than may be required. Water and treating chemicals are thus wasted.

Manual control of water treatment basin water levels and blowdown take considerable manhours of operating labor. Frequent chemical checks must be made daily, and some larger generating plants would need an extra employee for such checks.



KEY INSTRUMENTS are condensate flow meter (left), basin level meter, and make-up and waste water (blowdown) meter. Conductivity meter (right) may be added

Heat Load Approximated

In designing an automatic scheme for controlling water levels and treatment, advantage is taken of fundamental characteristics of cooling water cycles. Under ordinary conditions, the condensate flow from the hotwell is proportional to the condenser heat load. This flow may be used to approximate closely the heat load on the cooling towers.

Simply stated, about 1 lb of condenser cooling water must be evaporated for each pound of turbine exhaust steam condensed. It follows that makeup water must flow to the cooling tower basin at a rate very close to that of condensate flow from the condenser. Only such a rate can offset evaporation losses and maintain a constant water level.

Can Predetermine Ratio

Although replacement of evaporation losses only would afford a constant volume of water in the cooling system, the concentration of dissolved solids would increase so rapidly that the water would become unusable in a short time. This condition is prevented by bleeding water from the basin and replacing it with an equal quantity of fresh water. The total quantity of makeup water to be supplied becomes the sum of evaporation and windage losses and blowdown.

Generally the correct ratio of blowdown to evaporation losses can be predetermined from the raw water analysis. By maintaining this ratio, the required concentration of dissolved solids in the condenser water is produced. Thus it can be seen that the condenser heat load or a very close approximation can originate the initial impulse for all control functions.

Conductivity Cell Used

For raw water varying appreciably in quality, both the treatment and evaporation-blowdown ratio must be adjusted to meet changed conditions. A conductivity cell in the raw water stream acts automatically to bias the chemical feed control and alter the blowdown rate. A pH meter usually is installed in the cooling water system as a final check.

The accompanying schematic diagram shows the relationship of the several control functions. The condensate flow meter initiates the impulse which actuates the makeup water control valve. This impulse also positions the waste water control valve to make blowdown a fixed percentage of makeup water flow. Thus the ratio of blowdown to makeup is maintained under all conditions of condenser heat load.

A flow meter records makeup flow and controls the water treating equipment. Although the components of an acid-injection system are shown, the flow meter may be used to feed any chemical selected.

Controller Restores Level

The final control link is the basin water level transmitter and its recorder-controller. As long as makeup water and blowdown water are maintained correctly, the basin water level automatically holds within close limits. Consequently the level controller serves to restore the water level in an emergency, rendering the normally controlling functions inoperative.

Extra Cost Very Little

Cost of the control equipment ranged from $1,400 to $4,800, depending upon the system's complexity and the needs of the plant. In view of the installation of level meters and flow meters for the usual manually controlled system, the extra cost of fully automatic control is very little. Southwestern's seven applications indicate that savings and other advantages gained outweigh the small additional investment.

Louisiana P&L Decides on Vertical Bundling

Policy on bundling design was established as the result of trouble-free experience with 115-kv line and initial studies

H. L. DELONEY, Assistant Chief Engineer
W. L. RUSH, Transmission and Distribution Engineer, Louisiana Power & Light Co, New Orleans, La.

Trouble-free experience with an initial vertically bundled, 3-mile, 115-kv line during its first 16 months of operation has confirmed Louisiana Power & Light Co's design philosophy with respect to bundling. The company's policy on when to bundle and when not to bundle was also influenced by favorable results of preliminary studies and the low cost of building the 3-mile section (EW, Oct. 4, 1954, p 68).

Vertical bundling with 9-in. spacing was adopted rather than the horizontal configuration because of:

1. Lower installed cost.
2. Simpler hardware.
3. Greater stability from magnetic forces.
4. And no ground clearance problems.

All new lines are now designed for ultimate conversion to vertical bundling except those being built with 666-MCM ACSR or larger. This practice reduces fixed charges initially and provides a simple solution for increasing capacity when necessary.

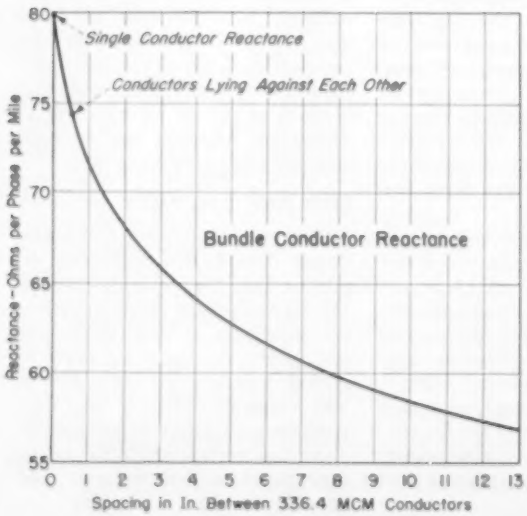
Existing 2/0 and 4/0 ACSR circuits can be economically bundled with 336.4-MCM ACSR when the existing conductor cannot be absorbed if taken down. However, general practice will be to remove the smaller wire when it may possibly be reused elsewhere and install either 666-MCM ACSR or bundled 336.4-MCM ACSR, depending on future loading possibilities.

Decision to bundle with 336.4-MCM or install a single 666-MCM ACSR conductor will be determined by the capacity needed and permitted expense. A bundled 336-MCM circuit costs $800 per mile more or 5% of the total circuit cost. However, its capacity, based on either thermal or impedance-drop limitations, will be about 30% greater.

When existing conductor is 336.4-MCM ACSR, it should be left in place and bundled with a 336.4-MCM, even though the existing wire can be absorbed elsewhere. This also holds true for 4/0 copper except when the price of copper is sufficiently high to dictate scrapping the copper and replacing it with a large-size ACSR conductor. If the 4/0 copper is not removed, it should be placed below the ACSR to prevent contaminating the aluminum with copper salts and eliminate possible trouble from the different thermal expansion coefficients of the two conductors.

The company started studying possibilities of bundling in 1951. Calculations were made to compare the electrical characteristics of single conductors versus bundles for

Adapted from a paper presented at the EEI Transmission and Distribution Committee meeting in New Orleans.



Formulas That Apply to Bundled Conductors

$$X = 0.2794 \log_{10} \frac{D_m}{\sqrt{r_s s}} \text{ ohms per mile}$$

D_m = Equivalent spacing, in feet (For all practical purposes this is the same as for the equivalent spacing of a standard line.)

r_s = Geometric mean radius of conductor, in ft

s = Spacing between subconductors in the bundle, in ft

$$B = \frac{1.015 \times 377 \times 1.610}{2h} \Big/ 18 \log_e \sqrt{rs\left[\left(\frac{2h}{d}\right)^2 + 1\right]} \text{ Micromhos per mile}$$

h = Average distance of bundle above ground, in mm

r = Radius of subconductor, in mm

s = Distance between subconductors, in mm

d = Equivalent spacing of line, in mm

No published equation for the capacitance of a line is exactly correct. The factor of 1.015 gives a more correct answer.

115-kv H-frame structures. The reactance was found to be lower with bundling, and capacity was increased.

Mechanical and magnetomotive effects were analyzed on a 3-span test section line using 336.4-MCM ACSR. Both horizontal and vertical bundle arrangements were set up with spacings of 6, 9, and 12 in. Tests consisted of applying various currents and determining the values at which conductors pulled together or just held, after being brought together.

These test results show that conductor conflict was less serious for the vertical configurations than for the horizontal. Nine-inch vertical separation gives as much stability as about 12 in. horizontal and was not subject to swinging from wind.

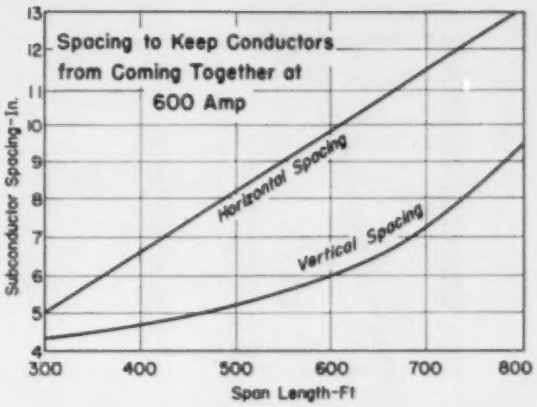
Moreover, hardware for the vertical arrangement was simpler. But little difference was found between the ground clearances and conductor swings for the two arrangements. This was because the yoke for the stabilizing horizontal bundles would have to allow about 9 in. drop and because the extra length of suspension string for vertical bundles encroached as much on the horizontal clearances under wind conditions as the horizontal bundles.

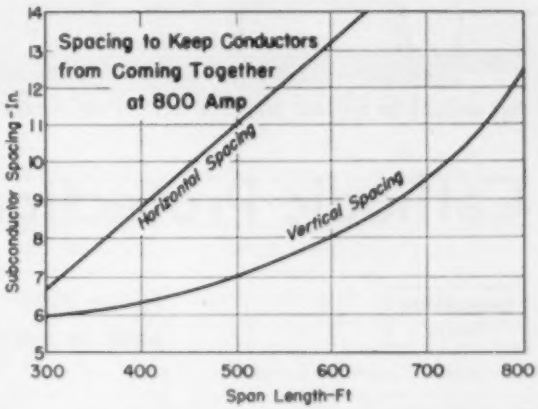
Unravelling or recovery ability of the vertical bundles was found to be excellent, even when conductors were twisted together several times using a pikepole. The conductors would always unravel and straighten out readily.

In analyzing the company's standard 115-kv design, the structures were found to have sufficient ground clearance to accommodate the 9-in. lower elevation of the subconductor. Moreover, existing line structures were found adequate, except when span lengths exceed 540 ft. In these cases cross braces are needed.

Certain types of angle structures required heavier poles and other slight modifications at the time of bundling, such as: Strengthening of guying; shifting of cross arms 6 in., on small angles, to compensate for the extra conductor; installing heavy pole bands; and substituting twelve 25,000-lb insulators for fourteen 15,000-lb units in deadend strings.

Ordinarily, only twelve 15,000-lb insulators would be required at deadend for single conductors. However, 14 are now being installed where future bundling is contemplated. Thus, when the 25,000-lb units are substituted, space will be provided for a triangular-shaped strain yoke without affecting sag of the existing line or necessitating cutting the conductor.





Other insulator strings consist of six 15,000-lb units in suspension and 12 units in side tension.

During bundling of the 3-mile section of 115-kv, 336 MCM line, for observation and cost purposes (EW, Oct. 4, 1954, p 68), the stringing operation was watched closely. Although the two conductors did wrap together when the subconductor was pulled in, they did not fail to separate. This experience indicated that prestressing could be accomplished in position to speed over-all operation.

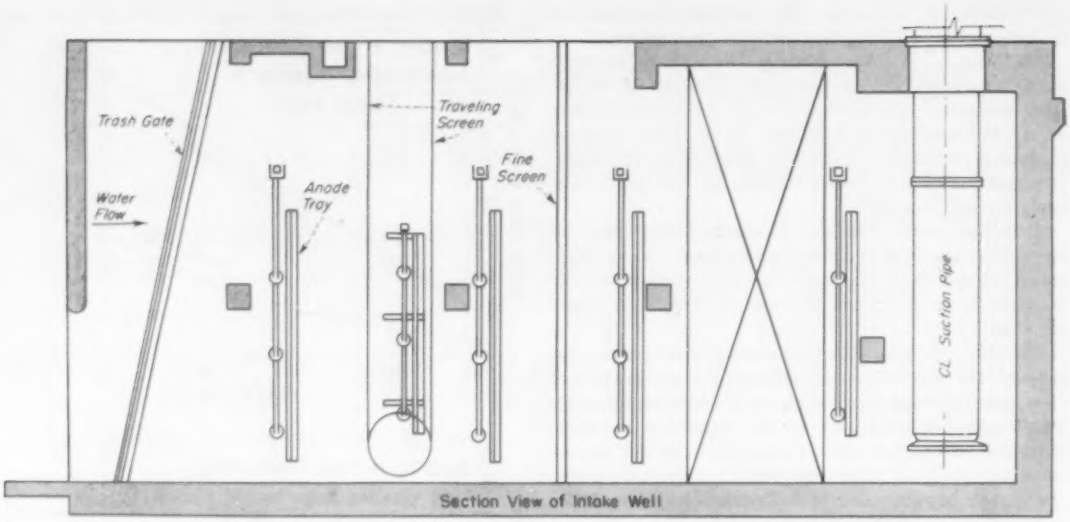
To assure that the two conductors are properly spaced at all times, a 6-in. turnbuckle and figure-eight link was installed between the deadend body of the lower conductor and the strain yoke assembly. This permitted a fine adjustment of the subconductor sag and will provide further adjustment if the two wires don't stretch uniformly over a number of years. No whiffletree action of the yoke was detected during sagging.

Preformed spacers were installed in four mid-spans. Based on limited experience, indications are that the spacers will not be needed, except possibly on spans longer than 650 ft.

Electrical Data for Bundled ACSR Conductors

Type of Line	Weight Lb/ Mile	Resistance Ohms/ Mile 25 C	Reactance Ohms/ Mile 0 Amp	Charging Mi-cro-mhos per Mile	Carrying Capacity Amp.
Bundle 2-2/0	5,820	0.353	0.685	6.90	540
Bundle 2-4/0	9,252	0.223	0.657	7.07	680
Bundle 2-336.4 MCM	14,652	0.139	0.591	7.24	1,060
Bundle 1-2/0 1-336.4 MCM	10,236	0.219	0.632	7.07	790
Bundle 1-4/0 1-336.4 MCM	11,952	0.185	0.619	7.11	845
Standard 2/0	2,910	0.706	0.902	4.93	270
Standard 4/0	4,626	0.445	0.872	5.09	340
Standard 336.4 MCM	7,326	0.278	0.799	5.30	530
Standard 666.6 MCM	13,581	0.147	0.760	5.58	800

All bundle conductor lines use a 9" spacing.
Equivalent phase conductor spacing is 17.6 ft.

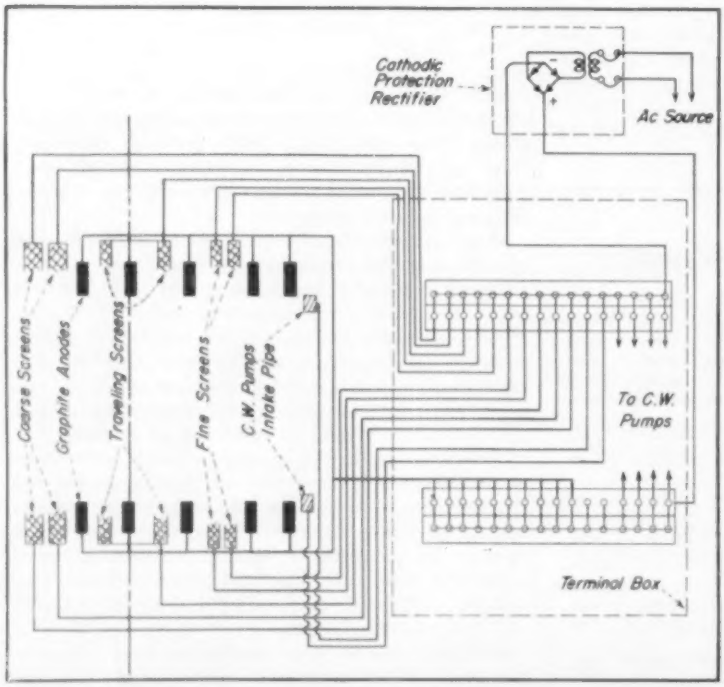


FIVE GROUPS OF ANODES INSTALLED ACROSS THE INTAKE WELL PREVENT DAMAGE TO STRUCTURES AND SCREENS

Cathodic Protection Cuts Repairs

GENERATION
Design

Florida Power & Light saves $10,000 annually per generating plant by installing equipment to stop or mitigate corrosion



FORCE DRAINAGE for intake structures is supplied from rectifier through terminal box. Current in circuits is controlled by resistors between terminals

J. B. PRIME, Jr, Florida Power & Light Co, Miami, Fla.

Cathodic protection is being effectively applied to structures and equipment at Florida Power & Light Co's generating plants that use salt water for condensing. Stopping or mitigating galvanic corrosion saves about $10,000 annually per plant by reducing maintenance and replacements.

Structures and equipment that are being protected and methods employed are:

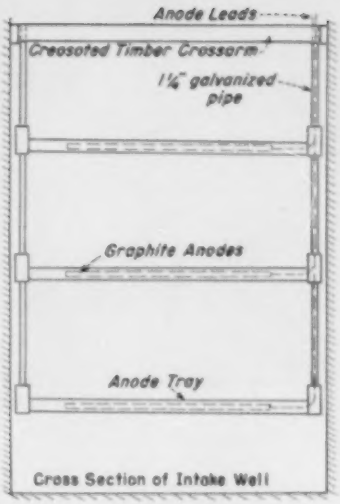
Underground structures — force drainage using a rectifier and graphite anode ground bed.

Intake structure — rectifier and graphite anodes. Isolation of structure from reinforcing steel and station ground is desirable as is the use of iron frames and copper screens.

Intake pumps—rectifier and graphite anodes. Neoprene coating of impeller, shaft, and shroud of the pump is being tried and appears feasible.

Condensers—magnesium anodes.

Adapted from a paper presented at the AIEE Southern District Meeting in St. Petersburg, Fla.



GRAPHITE ANODE LAYS IN ASBESTOS-CEMENT PIPE. THREE ANODES ARE SPACED VERTICALLY IN FIVE GROUPS

Gravity water-storage tanks—rectifier and aluminum-rod anodes.

The cathodic protection program began in 1947 following a survey of generating plants using the four-pin method with a vacuum-tube voltmeter to determine station soil resistivity. Tests were also made of the potentials between various subsurface structures and a copper-sulfate half cell, and potential shifts of these structures under the influence of impressed currents. Some plants were found to need protection because of low soil resistivity, while others located about the same distance from salt water did not.

Protection for underground plant structures was applied with rectifier and ground bed. The rectifier with variable taps on the transformer has an output of 50 amp at 18 v. The ground bed comprises ten 6-in. diam, 82-in. long, graphite anodes located in salt water about 800 ft from the building. Total dc circuit resistance, including ground bed, was 0.58 ohms.

Tests were made to determine the effectiveness of this method and obtain data for future installations. For these tests the rectifier output was set at 39 amp, and an interrupter was placed in the circuit to energize and de-energize the rectifier automatically. Desirable potential shifts resulted.

The IR drop along long sections of piping was also checked to determine bond points. Bonding is sometimes necessary to lower the resistance of return path for drain currents.

During the tests unexplained potential shifts were occasionally noted. They were finally attributed to welding generators that were centrally located and grounded. A long cable was extended for welding.

This practice resulted in currents greater than the protection current being impressed on subsurface structures. To avoid damage from the welder currents, the generator is now placed close to the work and grounded to the material being welded.

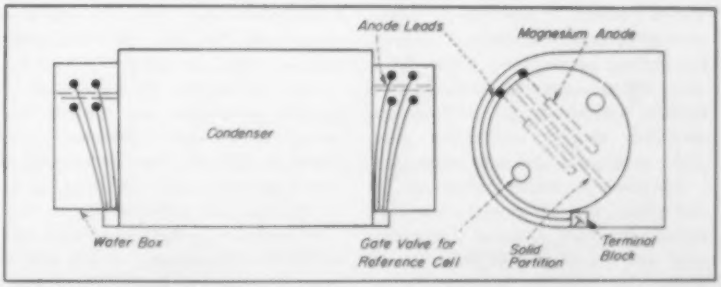
After six years of protection some of this plant's underground structure was inspected in conjunction with another job. All piping was in excellent condition, and maintenance records revealed few replacements.

Conditions at intake structures, including trash gates, screens, and circulating water pumps, were studied and tested to find protection methods, current needed, and the best metals for structures. Potential to copper sulphate for plants in the system after treatment varied from -0.85 to -1.17 v. Therefore, every plant has been treated individually rather than maintaining a unit potential for all plants.

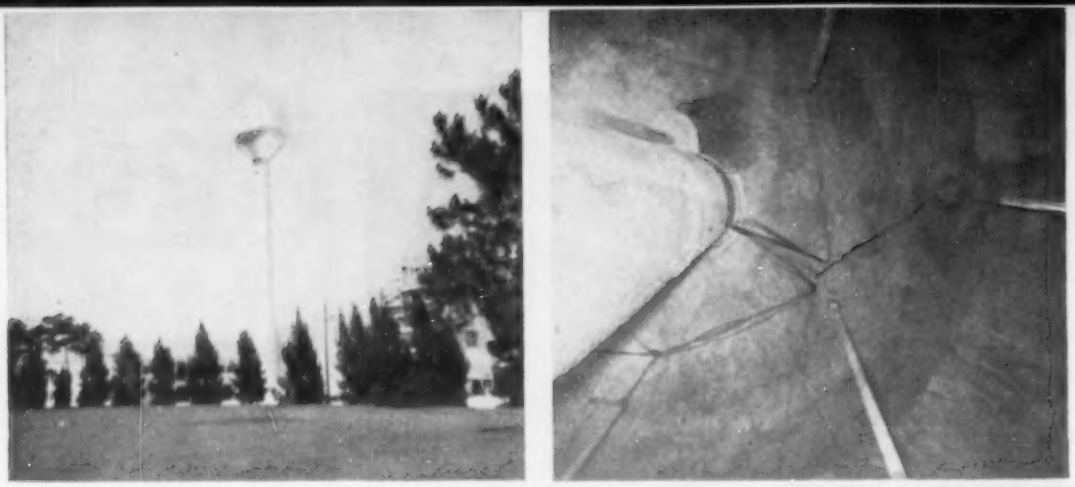
Zinc and magnesium anodes were tried first for intake structures but were given up because of insufficient available current. Therefore, a force-drainage design was adopted consisting of a 50-amp rectifier with graphite anodes suspended in trays.

Trays were made from 8-in. asbestos-cement pipe, split longitudinally, and framed with 1¼-in. galvanized pipes which were protected with controlled drainage. This type of tray has been in use over six years and has proved very successful.

The electrical system for galvanic protection of the intake structures in-



MAGNESIUM ANODES are installed in the water boxes of surface condensers to protect the boxes and the tubes from damage caused by local cell action



WATER TANK IS PROTECTED BY ALUMINUM RODS ARRANGED IN TWO CIRCLES, AS SHOWN LOOKING UP INSIDE TANK

corporates a terminal box through which all current to the structures is controlled. This is accomplished by inserting a resistor and calibrated shunt in series between the rectifier bus and individual circuits.

Difficulty was encountered with this protective method. Two new traveling screens, galvanized throughout, were installed along with initial force drainage. All structures were kept at -1.12 v to close copper sulphate. A year later the frames were found to be in excellent condition, but screen cloth had seriously deteriorated.

Decomposition resulted from two reactions: Very high akaline conditions on the surface of the structures (pH 12 to 14), caused by the protection current, corroded the zinc uniformly. Also, resistance between the screen and frames increased to the point where there was insufficient protection current on the screens.

For present installations requiring protection, a combination of iron frames with copper screens is being used, with good results.

The company's experience also indicates that structures should be isolated from reinforcing steel and from station ground. This gives better control of drain current and reduces the current required by about 70%. Also, higher current densities can be applied without danger of hydrogen evolution around reinforcing rods, with consequent concrete crackage.

Isolation is accomplished at all new plants and additions by not connecting structure guides to reinforcing steel and by insulation joints in all piping that connects between the intake wells and main plant.

On intake circulating-water pumps a negative potential is impressed on the impeller through brush holders contacting the shaft. The potential is supplied from the intake structure's terminal box. Test runs on two pumps, one with protection and the other without, revealed noticeably less pitting of the protected pump's impeller, shaft, and shroud.

Neoprene-Coated Impeller

A neoprene coating, 20-mils thick, was recently applied for protecting an impeller. Indications are that this coating with cathodic protection will give better results.

Magnesium anodes are used to protect the water boxes and tubes of surface condensers, the current of which reverses, from galvanic action. In a new unprotected condenser a current flows from the water boxes to the tubes and tube sheets. As areas of graphitization form on the water boxes, the current reverses.

This theory was proved at a plant having three new condensers which were fabricated with water boxes insulated from the shell. One unit was operated short-circuited to see if and when the current would reverse. The second unit was operated open circuited, and the third was protected and left open circuited.

After 17 months the zero point in galvanic potential and current occurred on the first condenser. The inside of this unit's water boxes had a thin graphite scale with pits up to ¼ in. deep and ½ in. wide.

In comparison the second unit was in excellent condition. It still had a negative potential and current flow, but water boxes showed signs of local cell action. The unit with magnesium anodes showed no signs of corrosion anywhere.

Therefore, protection was installed on all condensers. D-section magnesium anodes measuring 4 x 4 x 60 in. were used. For split, two-pass condensers two anodes were placed on each side of the partitions in water boxes and connected to terminal blocks with provision for resistors and shunts. Gate valves installed in the water boxes permit potential checks with an injection reference cell while the condenser is operating. This scheme has reduced tube failures.

Force drainage was first applied to a gravity water-storage tank following an inspection, after two years of operation, that revealed tubercules with pits underneath. Tubercules on the ¼-in. steel plates were more numerous at the bottom of the tank than at the top.

Water stored in the 100,000-gal, 26-ft diam tank averages 1,400 ohms per cc with a pH variance of 7.58 to 7.68 and chlorides of 35 ppm. Reference cell tests averaged -0.526 v to copper sulphate.

The protective method adopted uses 2-in. diam, 17ST aluminum rods as anodes formed in two circles. One circle is 11-ft in diam, to protect the water sphere tank core and the other is 20 ft, to protect the tank walls. Both sets of anodes are suspended from the top of the tank on insulated clevises.

With a drain current of 15 amp the anode life was calculated to be five years, and the potential to a reference cell was raised to -0.98 v. After a year of operation an inspection indicates all corrosion has been mitigated.

IMPROVED APPEARANCE because of equipment being inconspicuous amid shrubbery has been a major factor in persuading subdividers and home owners to pay the additional costs associated with residential underground distribution

EEI Underground Handbook Survey Shows . . .

Residential Distribution Adaptable

DISTRIBUTION
Design

30 Companies report various practices for cutting costs and obtaining reliability in serving new high-class developments

F. E. ANDREWS, Assistant Chapter Editor, EEI Underground Systems Reference Book, Commonwealth Edison Co, Chicago, Ill.

Residential underground distribution practices today reflect utility company philosophies which pivot on considerations as various as minimum cost and the maintenance of high service standards.

In the past decade such philosophies have been influenced by the growth of public interest in underground distribution in residential areas. Doubtlessly, this interest was prompted by the large number of high-class residential building developments since the war. Frequently, subdividers and owners oppose poles, wires, anchors, and guys common in overhead construction. Curvilinear streets and irregular property lines, characteristic of many high-class developments, also fostered the interest in underground distribution.

Most utilities require subdividers or home owners to pay the additional cost of underground distribution construction.

The diversity in underground practices is evident in the accompanying table, showing reporting utilities almost evenly divided in their use of the following:

1. The simplest construction using direct burial of primary cable, prefabricated transformer enclosures, and overhead type transformers.

EEI Underground Handbook Series Scheduled

This is the second article of a series on underground system design and operating practices based on material collected for Edison Electric Institute's Underground Systems Reference Book. Publication of the book, scheduled for the first quarter of 1956, is an activity of the EEI Transmission and Distribution Committee under direction of Editor-in-Chief J. A. Pulsford, Public Service Electric & Gas Co.

Text continues on page 113

Data tables begin on page 108

Residential Underground Distribution Design Practice

COMPANY	Appalachian Elec Pwr	Boston Edison	California Elec Pwr	Public Service Div, Commonwealth Edison	Public Service Div, Commonwealth Edison
Type of area	Residential, single	Residential	Deluxe residential	3,000 unit devel'm'ts	Residential, single
Primary					
Voltage, kv	7.2/12.5	2.4/4.16	4.8 and 4.16	2.4/4.16	2.4/4.16
Duct or buried	Buried, screened soil	Duct	3-in. non-met duct No concrete	Dir burial	Dir burial
Depth, in.	42	36	30 Min.	36–42	36–42
Cover	Creo board over sec.	Concrete; earth	Earth; concrete at crossings	Soil	Soil
Location	Side of street	Street	Street	Street, inside curb	Usually parkways
Manhole or handhole	None	Manholes	Pri junct box, concrete	None	None
Type system	Radial	Radial	Radial	Combin. loop; throwover	Radial taps from OH
Sectionalizing	None	None	Positect cutouts in manholes; tsf enclo	Porcelain discon in tsf enclo	Porcelain discon in tsf enclo
Cable Description					
Size & conductor	No. 6 Cu	No. 4 Cu	1/c 2/0; No. 2; 6	2/c conc No. 6; 1/0 Cu	2/c conc No. 6; 1/0 Cu
Insulation	11/64 ozone resist, shielded	5/64 ozone resist	10/64 syn 5-kv sh'lded	9/64; 10/64 corona resist rubber	9/64 corona resist rubber
Jacket	5/64 Neoprene	6/64	4/64; 5/64 Neoprene	3/64 Neoprene	3/64 Neoprene
Neut cond	Separate common	Sheath neut	No. 2; 4 bare	7 No. 14; 20 No. 14 bare Cu concen over jacket	7 No. 14 bare Cu concen over jacket
Lightning Protection	At OH connect only	At OH connect only	At OH connect only	At OH; tsf connect	At OH connect; tsf
Cable termination	RI cable connect at oil cutout in tsf enclo	At tsf tank wiping sleeve	Shield stripped back; gr'nded	Cable end left clear	Cable end left clear
Secondary Mains					
Voltage	220/240, 3-w	120/240	120/240	120/240	120/240
Duct or buried	Dir buried, screened soil, board cover	Fiber pipe in fine dirt; filled with comp'ned, plank cover	2-in. duct	Dir burial	Dir burial
Depth, in.	36	30	30	36 or 6 above pri	36 or 6 above pri
Location	Side of street	Street	Street	Street	Street
In primary trench	Yes	Some	Some	Yes, if on same route	Yes, if on same route
Cable Description					
Size & conductor	4/0 Cu	1/0 to 4/0 Cu	.....	No. 2 Cu	2/0 Cu
Insulation	5/64 RHRW	5/64 Rubber	4/64 thermo-plastic or RWRH Neoprene	4/64 RH	4/64 RH
Jacket	4/64 Neoprene	Double braid	.....	3/64 Neoprene	3/64 Neoprene
Neut cond	2/0 bare	No. 4-1/0 bare tinned Cu	No. 4 bare Cu	No. 2 bare Cu	No. 2 bare Cu
Services					
Size & differences from main	No. 7 Min.	2 No. 6 in iron pipe R&L; No. 6 bare Cu	As required by load	2 No. 8 insula; jacket same	3-w No. 2 recom. insula; jacket same
Owned by customer	Yes	Yes	2/3	Yes	Yes
Connection arrang'm't	Crab joint in 30-in. concrete handhole	To main in buried wood box filled with comp.	Dir from tsf sec box; bur'd sec serv box	Dir. No box; pedestal	Dir. No box; pedestal
Transformers					
Type	OH conv, sealed tank	Subway	OH CSP, no arrester	OH CSP	OH CSP usually
Size, kva	25–37½	25–50	5–50	15–50	37½ Max
Enclosure	48 in bur'd conc pipe	Manhole	Corrugated steel on conc base, semi-bur'd	Conc tile above or part above grd	Conc tile above or part above grd
Sectionalizing and switching at tsf	None	None	Sec. switching	Usually	If needed
Street Lighting	Control cable in trench with sec	In split fiber duct with sec	Same trench	Independent	Independent
Telephone Cable	.....	Independent	.....	Independent	Independent
Cost Ratio, UG/OH	3.8:1	.....	2.5 to 5:1	2 or 3:1	3.5 to 5.5:1

of 30 Electric Light and Power Companies

Consumers Pwr	Dallas Pwr & Light	Dayton Pwr & Light	Detroit Edison	Company "X"	Hawaiian Electric
Deluxe single resid's	Deluxe single resid's	Deluxe single resid's	Deluxe residential	Resid'l single; group	Deluxe single resid's
2.4/4.16	7.62/13.2	4	4.8 open delta	4.16	2.4/4.16
Dir burial	Dir burial	Conduit; manhole	Dir burial	Duct	Dir burial multiple cables
30	30	.....	36	42 Min	24
Sand; concrete blocks	Screened earth; slab	.....	Crown tile	.....	Screened soil; slab
Public drives	Rear lot	Parkway; lot	Rear lot	Street	Inside of sidewalk
None	None	Manholes	None	Manholes	None
Loop	Radial	Radial	Primary ring	Radial	Loop; transfer manual
.....	UG pri sect'liz'd manually at tsf bank	Usually none	Discon pothead in kiosk	Yes, with emerg transfer on pri	Discon at tsf
No. 6 Cu	No. 6 Cu	1/c No. 2 Cu	3/c No. 2	2/c; 4/c No. 6 Cu	1/c No. 4; 1/0; 4/0; 350 MCM Cu
3/64 corona resist	Part VC lead sheath; part rubber	16/64 VC 15 kv	7/64 VC	Paper; lead	On 350 MCM-11/64 RI 10/64 RI; 5-kv sh'ld'd
3/64 Neoprene	Steel; jute, Neoprene	Lead	5/64 lead; Neoprene	.....	Neoprene No. 4-4/64; 1/0; 4/0-5/64; 350 MCM 6/64
7 No. 14 tinned Cu armor wires, spiral	No. 6 bare medium HD common	No. 2 WP common	None	None	Bare common. ½ size of largest pri or sec
At OH connec only	At OH connec only	At OH connec only	At tsf	At OH connec only	At OH connec only
Armor stripped back; grounded	With stress cone at tsf terminal	Wiping sleeve in tsf or oil cutout	Directly to ts	Potheads at term pole Wiping sleeves at tsf	Stress cone
120/240	No secondaries	120/240	120/240 3-φ	120/240 3-φ	120/240
Dir burial	120/240 v 3-φ 4-w services from tsf	Duct	Dir burial	Ducts	Dir burial; slab
30	.....	Duct bank with pri	36	42 min	24
Seperate trench	.....	Duct bank with pri	Rear lot lines	Street	Same as pri
No	.....	Yes	Yes	Same duct bank with pri and street light	Yes, 1 ft from pri
1/0 Cu	.....	No 1/0; 300 MCM Cu	4/c 4/0; 4/c 1/0	2-1/c 250 MCM, 2-1/c 500 MCM	1/c No. 4/0 Cu
5/64 RHRW	.....	RHRW Neoprene jacket	3/64 RHRW	Paper; lead	5/64 rubber 600 v
3/64 Neoprene	.....	Neoprene IPCEA	3/64 Neoprene	.....	4/64 Neoprene
.....	Common neut	Common	4/0; 1/0 rubber; Neoprene	Sep'te neut 4/0 bare	Bare common. ½ size of largest pri or sec
.....	120/240-v 3-φ 4-w	Similar	Installed by customer	2-1/c No. 3 paper; lead; No. 3 bare	3/c No. 4 RINJ 600-v, 4/64 insul and 7/64 jacket
Yes	Yes	Yes	Yes	Conduit cust owned except for multiple dwel	Yes
To fused terminal in junction box	Enter top of tsf housing conn to sec bus	In manholes	Through fuses at serv pedestal	Jointed in manholes	Moles in concrete box
Conv	CSP OH type	Usually subway	SP OH type	Subway	OH convent
.....	Max 3-ph bank 1-25; 1-15	25-50	5-50	25-100	100-Max
Semi-bur'd conc box Galv cover	Semi-buried vault	Manholes	Kiosk	Manholes	Steel cylinder & concrete pipe base 2/3 buried
Isolating links	Pri manually sect'lized at tsf bank	None. Pri manually sect'lized at tsf bank	Sec fuses only	Oil cutout at tsf	2-proc cutouts in transfer arrangement
None yet	None	Separate	Pedestal to light via property line	Series cir in duct bank with pri; sec	Independent
.....	.....	Adjacent	Same trench	Separate	Same trench, sep cond't
3.5:1	2.5:1	.....	2.5 to 5:1	Depends on conditions	2.5 to 6:1

Residential Underground Distribution Design Practice

COMPANY	Iowa Electric L & P	Jackson, Tenn., Municipal System 1949	Jackson, Tenn., Municipal System 1951	Kansas City P & L 1931	Kansas City P & L 1951
Type of area	Apartments	Single residences	Single residences	Deluxe single resid's	Single resid ranch
Primary					
Voltage, kv	2.4/4.16	2.4/4.16	7.2/12.5	2.4/4.16	2.4/4.16
Duct or buried	Dir burial	2-in. Transite	Dir burial	Dir burial	Dir burial
Depth, in.	30	30	24-30	36	36
Cover	4-in. sand; creo plank	Old crossarms	Old crossarms	Soil	Soil
Location	Vaults in rear	Parkway next curb	Parkway next curb	Rear lot	Rear lot
Manhole or handhole	Vaults in rear	None	None	For tsf only	None
Type system	Radial	Radial tap from OH	Loop	Loop	Loop
Sectionalising	None	None	Discon poth'd in vault	.....	.....
Cable Description					
Size & conductor	No 6 Cu 5 kv	No. 3 Cu	No. 4 Cu	2/c No. 2	1/c No. 8
Insulation	GE-Super coronal 10/64 insulation	10/64 rubber 5 kv non-shielded	19/64 rubber 15 kv shielded	Class 1120-11 in. 10/64 in rubber; tape.	8/64 Polyethylene
Jacket	4/64 in jacket	3/64 in Neoprene	5/64 in Neoprene	Trenchlay	4/64 in PVC
Neut conductor	No. 6 W P	No. 4 bare same duct	No. 4 bare same trench	1/0, 7 strand bare Cu common neut	Common neut
Lightning Protection	At OH connect only	At OH connect only	At OH connect only	At OH connect only	At OH connect only
Cable termination	.....	Dir tape connect	Potheads at tsf	.....	.....
Secondary Mains					
Voltage	120/240	120/240	120/240	115/230	115/230
Duct or buried	Dir burial	Dir burial	No sec	Dir burial	Dir burial
Depth, in.	30	24	.....	.....	.....
Location	.....	Parkway	.....	With pri	With pri
In primary trench	Separate trench	Yes.	.....	.....	.....
Cable Description					
Size & conductor	No. 2 to 250 MCM	1/0 Cu	.....	3/c 1/0 to 300 MCM	1/c 1/0 600 v Neoprene
Insulation	GE Versatol Geoprene 600 v 4/64 to 6/64 in.	600 v Okonite	.....	.....	.....
Jacket	3/64; 5/64-in. jacket	3/64-in. Neoprene	.....	.....	.....
Neut conductor	.....	No. 4 bare Cu	.....	.....	.....
Services					
Size & differences from main	.....	1/0; No. 3 Cu same insul jacket as sec	Services dir from vault Meters on wall of vault	.....	.....
Owned by customer	Utility owned	No	Yes	Yes	Yes
Connection arrang'm't	Connect at tsf terminal	8-in. tile junct box 6 in. below surface	In meter socket	Junct box	Junct box
Transformers					
Type	CSP	OH CSP less arresters	OH CSP less arresters	Subway	CSP
Size, kva	.....	50-max	50 max	.....	.....
Enclosure	Semi-buried conc tile 26-in. dia 26-in. high	36-in. conc tile semi-buried	36-in. conc tile semi-buried	Manhole	Semi-buried
Sectionalising and switching at tsf	None	None	Potheads at tsf	Transfer switch	No-load switching
Street Lighting	No	None as yet	None as yet	No	No
Telephone Cable	No	Rear property	Generally separate	.....	.....
Cost Ratio, UG/OH	1.5 to 3:1	3:1	3:1	.....	2.27:1

of 30 Electric Light and Power Companies (Continued)

Long Island Lighting	Los Angeles Dept. W & P	New Orleans P S	Northern States P'w'r	Pacific G & E	Pennsylvania P & L
Deluxe single resid's	Single residences	Deluxe single resid's	Deluxe single resid's	Deluxe residences	Deluxe residences
7.62/13.2-24/4.16; 2.3 delta	4.8	13.8	2.4/4.16	2.4/4.16	2.4/4.16
Conc duct	Transite	Duct; manhole system	Ducts; dir burial	3 in. non-met. No conc	Fiber in conc; dir burial
24	30	36	24-36	30	30
Soil-sand	Soil	Soil	Soil; creo planks	Soil	Street
Rear lot; parkways	Rear lot	Btn sidewalk & curb	Rear lot; street	Street; rear lot	Street
Tsf vault	None	Yes	Both	Precast conc serv box	Manholes; handholes
.....	Radial	Open loop	Radial	Loop; radial	Radial
Sect'lizing switches	None	Load break switch	Yes	Porc box discon OH	Several sect each tsf from diff OH point
13.2 kv 1/c No. 4 4.16 kv 1/c No. 2 Cu 13.2 kv-220 mil paper 4.16 kv-110 mil paper	3/c No. 6	No. 2 Cu	.....	1/c No. 6 to 1/c No. 2	1/c No. 6 to 1/c 1/0
	Paper	Rubber-D-574 shielded Neoprene	PILC	Oil base; ozone resist comp. 5-kv shield IPCEA	VC-P'r or rub LC—5 kv
Neoprene	Lead	.....	.....	Neoprene IPCEA specs	Lead
.....	.....	Neut common with sec	.....	Bare. Same size, same conduit as insul phase	Bare
At OH connect only	None	On OH connect only	At OH connect only	None	At OH connect only
1/c potheads	Pothead at pole	Connected to discon	.....	Stress cones	G & W oil fused CO wiping sleeves
115/230	120/240	120/240—3 ph	120/240	120/240	120/240
Dir burial	Transite duct	Duct	Dir burial	3-in. non-met	Duct
24	30	30-36	.....	30	30
Same trench as pri	Rear lot	Parkway with pri	.....	Same as pri	Streets
Yes	Yes	Yes	.....	Yes	Same duct
1/c No. 2-1/c 1/0; 1/c 4/0	2-1/0 600 v	4/0 Cu	System purchased	1/c 1/0, 250 MCM	.....
4/64-in.; 5/64 in. rub	Rubberlike	5/64-in. rub	Values unknown	Oil base; ozone resist comp 600 v—IPCEA	1/c; 2/c 600 V L&R; Rub & Neoprene
3/64 in. Neoprene	.....	4/64-in. Neoprene	.....	Neoprene IPCEA	.....
.....	1-1/0 600 v Rubberlike	Separate 4/0 4/64-in. Neoprene	.....	Separate No. 2 bare Cu; 1/0	Bare common
Owner's choice	Rubberlike	Owner's choice	Similar	Customer specifies	Dir burial
Yes	No	Yes	Yes	Yes	Yes
.....	Busbar on pedestal or pad	In manhole at curb Molex; 100-amp fuses	Buried	Various. Split-bolt con usual	Bugged & taped; or soldered
OH CSP less arresters	Overhead CSP	OH convent	Most convent on poles; subway in manholes	CH	Convent; submersible
Mostly 10 kva	25 kva	1-167; 2-100 kva	.....	.....	.....
Semi-buried vault	Inverted metal container on pad	Brick house above grd	Some manholes	3 x 5 x 4-ft sheet steel	Manholes
None	None	Open disc each way	.....	Yes. At tsf as above	None
None as yet	No	Cable in duct bank	No	Independent	Yes
Same trench. 12-in. sep	Same trench. 12-in. sep	Separate	.....	Same trench often	Adjacent ducts
2:1 to 5:1	2:1 to 4:1	10:1 to 12:1	.....	Was 2:1, is 4:1 to 5:1	.....

Residential Underground Distribution Design Practice

COMPANY	Philadelphia Electric	Puget Sound P & L	So. California Edison	Union Electric	Utah P & L
Type of area	Apartm'ts	Resid'l	Resid'l subdiv	Resid	Deluxe single resid's
Primary					
Voltage, kv	2.4/4.16	2.4/4.16	2.4/4.16	2.4/4.16	7.2/12.47
Duct or buried	3-in. fiber, no conc	Min Z in non met duct; conduit	3-in. fiber duct; in conc	Transite duct; no conc	Fiber in conc
Depth, in.	.....	24	24 min	24	30
Cover	.....	Sand; treated plank	Soil; conc envelope under streets	Soil	Soil
Location	In sidewalk	Rear lot	Rear lot	Parkway	Rear lot
Manhole or handhole	None	.....	4 x 2½ x 3-ft pull box	Manholes	Semi-buried tsf house
Type system	Sectionalized radial	Radial from OH	.....	Radial	Radial
Sectionalizing	Oil fuse CO	Looped through vt	.....	None	At tsf vt
Cable Description					
Size & conductor	.....	1/c No. 4 Cu min	3/c No. 2 Cu mains 1/c No. 6 tape	No. 6 Cu	No. 4 Cu
Insulation	Rub—5 kv	Syn. RI IPCEA	Rubberlike	11/64-in. oil base rub	19/64-in. rubberlike
Jacket	Lead	Syn rubber	Neoprene	4/64-in. Neoprene	Shielded Cu tape. 5/64-in. Neoprene
Neut cond	Bare Cu separate	No. 4 WP min	No. 4 WP Cu for mains No. 6 WP Cu for taps	6 No. 14 tinned Cu spiral wound	.....
Lightning Protection::	.....	None	.....	At OH connect only	At OH connect only
Cable termination	Connected to oil fuse CO or LC tsf lead	In porc box CO	.....	In porc box CO	.....
Secondary Mains					
Voltage	Sec mains not used; Serv dir from tsf.	120/240	120/240	120/240	No sec
Duct or buried	.....	None	Fiber duct	Transite duct	Customers bring serv to tsf
Depth, in.	.....	24 in. min	Above pri ducts	24 in.	.....
Location	.....	.....	Lot	Parkway	.....
In primary trench	.....	.....	Same duct	Same duct	.....
Cable Description					
Size & conductor	.....	.....	2 1/0 Cu min to 250 MCM and 2/0 neut	4/0	.....
Insulation	Non-leaded rub	.....	Rubberlike	5/64-in. rubber	.....
Jacket	.....	.....	Neoprene	3/64-in. Neoprene	.....
Neut cond	.....	.....	No. 2 Cu for 1/0 ph No. 2 Cu for 250 MCM	.....	.....
Services					
Size & differences from main	.....	No. 2 min dir burial	1/c No. 4, rubberlike insul 3/c twisted	No. 2; 4/0 dir burial	Supplied by customer
Owned by customer	Yes	Yes	.....	Yes to property line	Yes
Connection arrang'm't	Bus at tsf	Bus at tsf	Split-bolt or indent type con't'r at term box	Split bolt in handhole taped	Junct box
Transformers					
Type	OH	OH	CP	CSP less arresters	OH CP
Size, kva	25-75	50 kva max.	15-25	15-100	.....
Enclosure	Conc block; brick below surface	Recent 42 in conc tile semi-buried	Semi-buried tsf vault of concr blocks	Precast concr sewer tile	Semi-buried vault
Sectionalizing and switching at tsf	Yes	No	.....	For multiple tsf	S&C Positect fuses
Street Lighting	Cable buried with pri	None yet	.....	Separate system	None as yet.
Telephone Cable	.....	Same trench 12 in sep	Same duct line	Separate trench	Same duct run
Cost Ratio, UG/OH	.....	3:1	3 to 5:1	.....	4:1

of 30 Electric Utilities

The Public Utilities Comm London, Ontario	Hydro Electric Power Comm of Ontario	City of Calgary Alberta
Residence	.....	New resid's
2.3	4.16	2.4/4.16
2 in fiber in conc	Transite duct	Transite
30	9	.....
Earth	Sidewalk	Earth
Behind curb	Under street edge	.....
Handholes at turns	Handholes at crossing	Kiosk
1-ph loops from OH	Radial	.....
At each tsf	No	Yes
1/c No. 6	1/c No. 6, No. 2	1/c No. 6
Polyethylene	Polyethylene	Polyethylene
No jacket	No jacket	No jacket
No. 6 bare	No. 6 WP or larger	No. 4 WP
At OH connect only	At OH connec only	.....
Dir into porc CO	.....	.....
115/230	.....	.....
Dir burial; covered with concr blocks	Buried-c osed loops from each tsf	Dir burial
36	6 to 9	36
Rear of building	Under sidewalk edge.	.....
Generally not	.....	Yes
1/c No. 2 Polyvynlchloride,	1/0 Polyvynlchloride	No. 2 Polyvynlchloride
No jacket	No jacket	No jacket
No. 2 bare	Common with pri	Bare neut
Same trench as sec No. 4, No. 6 PVC	2 No. 4 PVC, 1-No. 6 bare neut	2-No. 2 PVC 1-No. 4 WP
No	No	.....
Connect box on basement wall outside	Solderless-taped, in asphalt filled box	.....
Standard OH	Convent'l or CSP OH	CSP
25	Up to 100	.....
Rectangular kiosks. Reinforced concr	Rectangular kiosks, emi-buried concr	Semi-buried conc sewer tile. Conical steel cover
Yes. Connect to CO	Fused porc box CO	.....
Yes	Yes. With sec	Yes. With sec
No	No	Yes. With sec
1.25:1 (1947)	1.22:1	3:1

OVERHEAD-TYPE TRANSFORMERS are installed in prefabricated enclosures by majority of companies reporting to EEI

Residential Distribution Adaptable

(*Continued from page* 107)

2. The in-between installation which employs nonmetallic duct without concrete envelope, prefabricated transformer enclosures, and overhead type transformers.

3. The more elaborate installation with conventional conduit and manhole type construction.

Implicit in these designs is the fact that residential underground systems today are operated by men trained in overhead system operation. Such training is desirable as residential underground systems normally are surrounded by and closely integrated with overhead systems.

Utility efforts to cut residential underground distribution costs have been directed at development of low-cost cables, cable terminations, transformer enclosures, junction boxes and other methods of sectionalizing, and of construction methods for the direct burial of cable. Such efforts have resulted particularly in the wide use of cables with ozone resistant rubber insulation and Neoprene jacket.

In the 5-kv class, 2/c concentric cable with rubber insulation and Neoprene jacket is used extensively. Around the circumferences of such cables, bare sheath wires are wound spirally. Polyethylene insulated cable without jacket has been installed on a trial basis.

Secondary cable with rubber insulation and Neoprene jacket are common to most installations.

Service connections may be taped or buried, or several services may be brought to connection pedestals or boxes at lot intersections. Often provisions for disconnecting secondaries in each direction serve as secondary sectionalizing. But services tapped directly to the main, without access and disconnection provision, have proved as satisfactory. Secondary and service cable faults have been very few, except at old installations where insulation had deteriorated badly.

According to utilities reporting, most installations use overhead type transformers. Enclosures for these have been of several prefabricated types, such as precast concrete similar to sewer pipe, metal, or combinations of these. Some installations have the conventional conduit and manhole designs, and kiosk or cubicle enclosures are also used.

Although overhead type transformers have been used extensively, self-protected types, not requiring fused cutouts, have been installed in enclosures having limited space.

90-Deg Relay Connections Urged

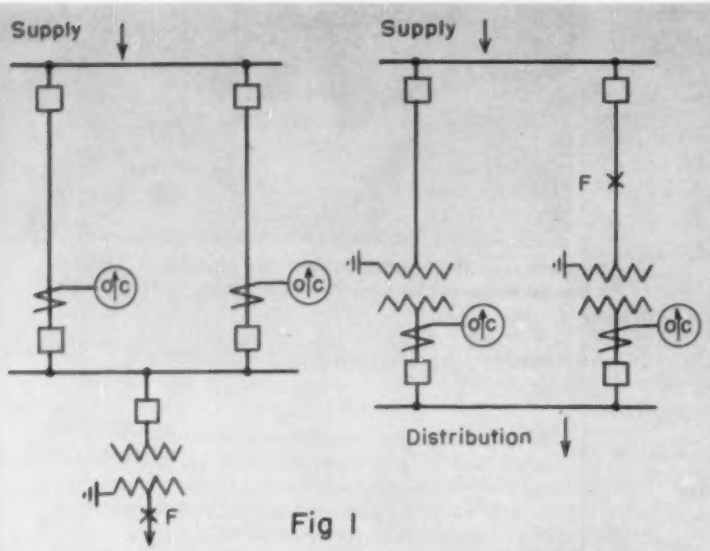


Fig 1

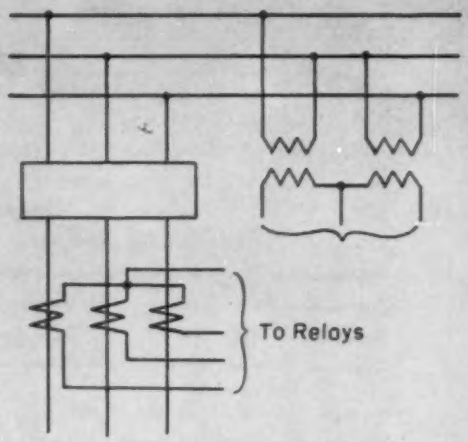
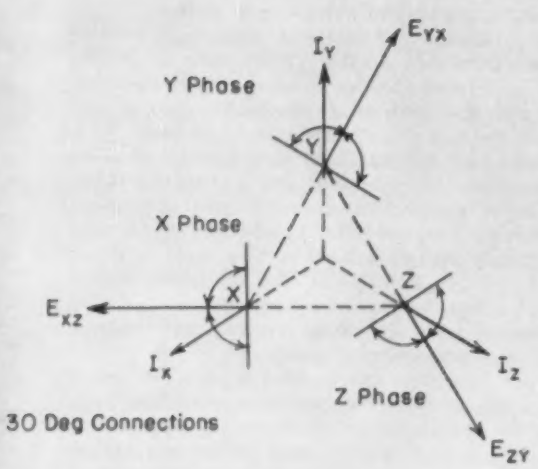


Fig 2



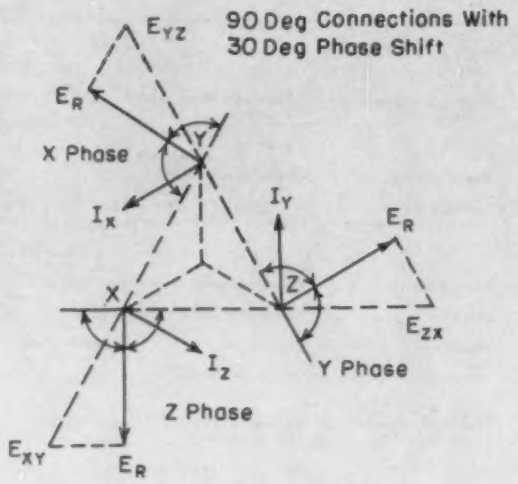


Fig 4

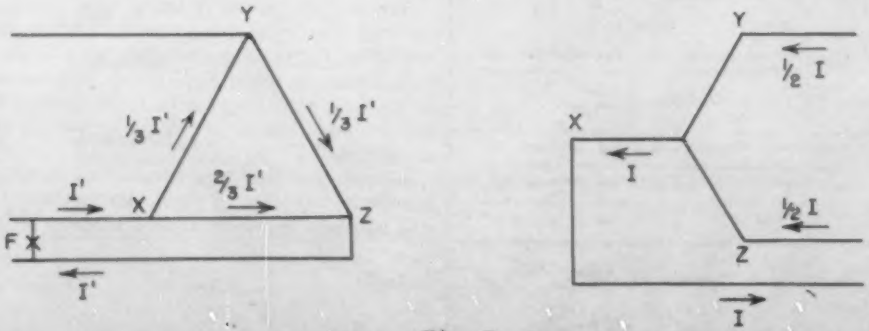


Fig 6

Widespread use of wye-delta transformers held cause of incorrect operation of directional relays with 30-deg connections

J. L. MILLS and H. P. DUPUIS, Relay Section, Commonwealth Associates, Inc, Jackson, Mich.

Replacement of 30 by 90-deg overcurrent relay connections with a 20 or 30-deg shift is recommended by Commonwealth Associates, Inc, on the basis of operating experience and a relay study. There is one exception to this recommendation. A relay subjected to a highly leading power factor may need the 45-deg shift.

As only two general types of faults were explored, it is emphasized that the 90-deg connection should not be considered a cure-all for directional element problems. It is not invariably true that a directional relay operates only for faults in the forward or operating direction but not for those in the reverse or non-operating direction.

Wye-Delta Complicates

Widespread use of wye-delta transformers has complicated relaying problems. Often it creates fault conditions causing incorrect operation of directional relays with 30-deg connections. When such relays are directional away from a wye-delta transformer bank, a phase-to-phase fault on the far side of the transformer may produce incorrect operation.

Connections in Fig 1 probably can be found on most power systems. They hold a greater probability of incorrect relay operation than is perhaps generally realized. With little or no backfeed on such installation, the relays usually are set on a low-current tap limited only by the relays' thermal ability to carry incoming load currents. Time delay is made as brief as possible.

Normal connections to the relays on such systems are shown in Fig 2, the directional element receiving line current and line-to-line voltages. The phase relation of current and voltage vectors at unity power factor is represented in Fig 3. Vector relations for each relay can be made more explicit by extending the vectors to the points of the triangle. The commonly used 30 and 90-deg connections are then as shown in Fig 4.

Value Triangulated

Directional elements have wattmeter characteristics with maximum torque when the current and voltage are in phase. When voltage is used as a reference, the operating zone is represented by a semicircle. Positive (closing) torque is then obtained, current leading or lagging the voltage by less than 90 deg.

The 90-deg connection is seldom used without a compensator. Compensators are resistors connected in series with the relay potential coil so that the voltage across the relay coil, ER, leads the secondary voltage by 20, 30, or 45 deg, depending on the resistance value used. The 90-deg connections in Fig 4 have a 30-deg shift.

When there is a fault at F in Fig 5, the relative distribution of current in the transformer is as shown in Fig 6. Vector relations are shown in Fig 7. Operation of the directional elements is determined by triangulating the associated values of current and voltage. These values are given in Fig 8 for the 30-deg and in Fig 9 for the 90-deg connections. Solid lines represent the current through Relay A; dotted lines the current through Relay B.

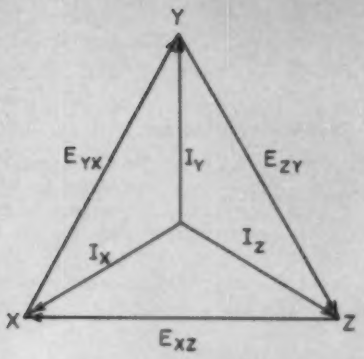


Fig 3

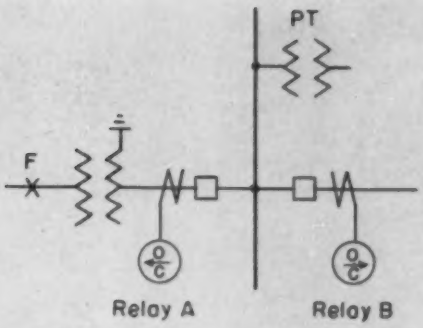


Fig 5

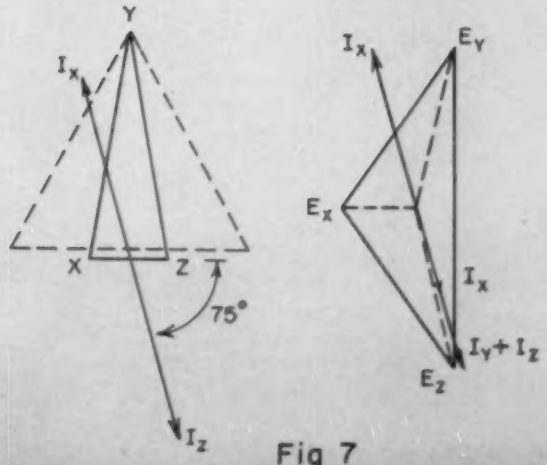


Fig 7

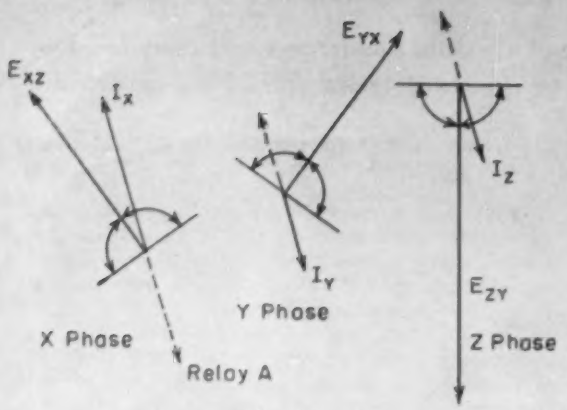


Fig 8

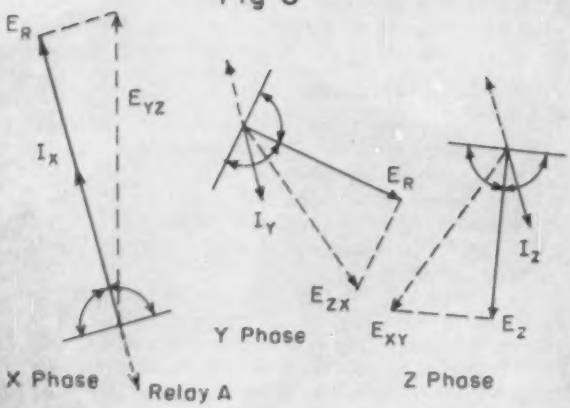


Fig 9

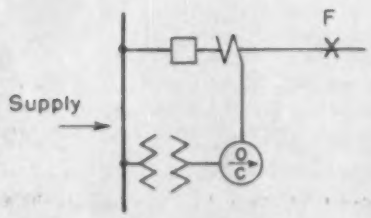


Fig 10

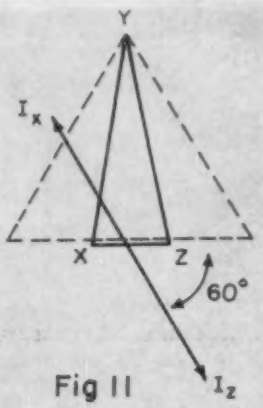
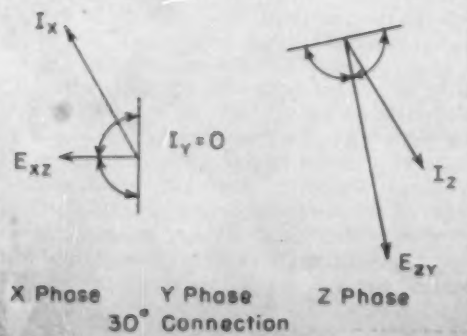


Fig 11



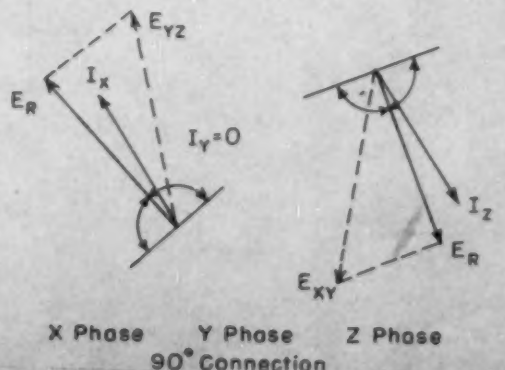


Fig 12

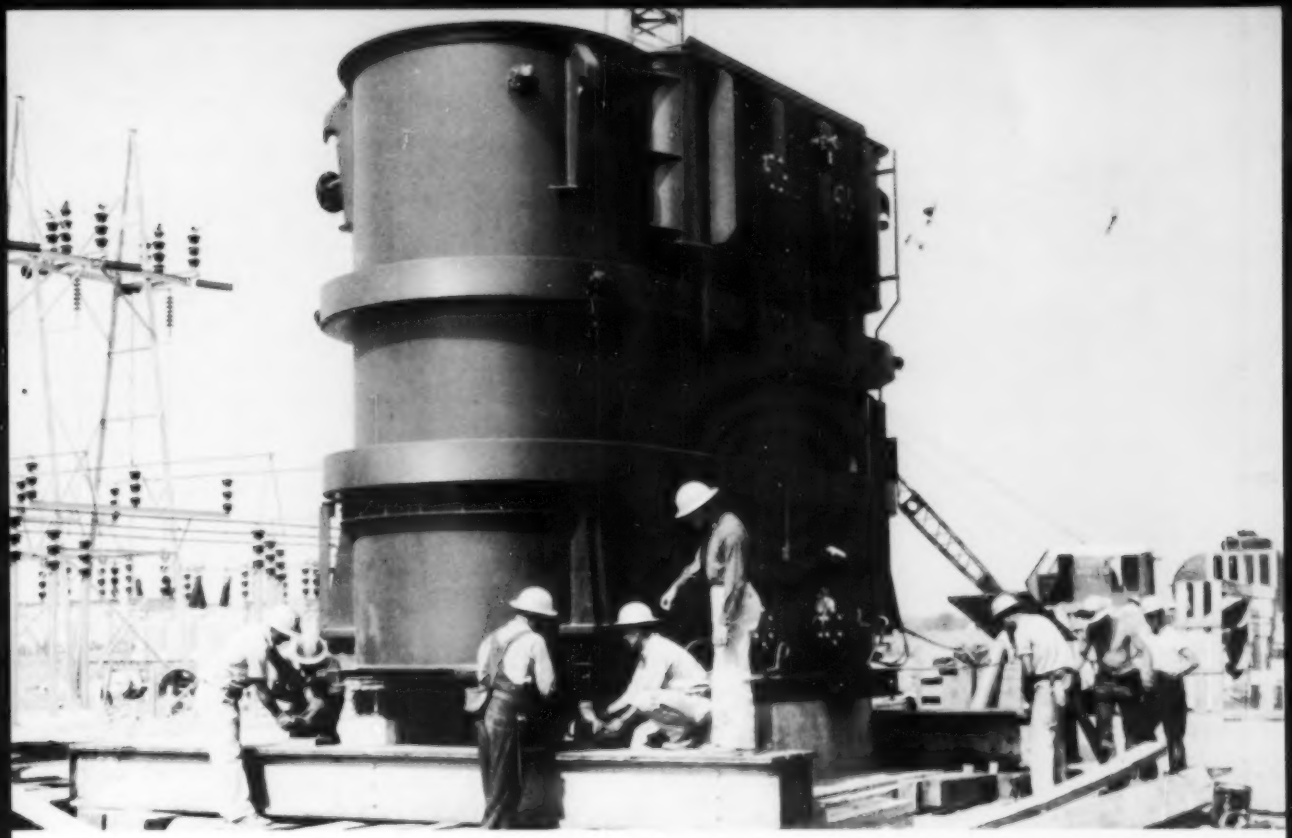
As Fig 8 shows, one directional element of Relay B with a 30-deg connection gives an incorrect indication by having a contact closing torque for a fault in the non-operating direction. As shown in Fig 9, this fault condition can be corrected by the use of 90-deg connections.

The Y phase of Relay B, in particular, may operate incorrectly, as it receives one of the lesser currents, ½ I in Fig 6. When non-selective relay operation is sought, Relay B must be non-selective with Relay A when the latter receives twice as much current as Relay B. When relays are set on low tap values, relay operation is more likely to be non-selective. Conditions are similar whether the relays are on the wye or the delta side of a wye-delta transformer.

Both Relays Have Torque

Fig 10 shows the connections for a normal line-to-line fault in the operating direction when no transformer is involved, and Fig 11 gives the pertinent vectors. Vectors applicable to the directional elements for the 30 and 90-deg connections are shown in Fig 12. Value triangulation shows that positive operating torque is obtainable with only one relay when 30-deg connections are considered. The second relay receives the collapsed voltage with a very poor power factor angle.

Use of the 90-deg connection with 30-deg shift, however, results in both relays receiving positive operation torque. For some conditions neither 30 nor 90-deg connections assure correct operation for line-to-ground faults.



Can you save money by evaluating power transformer installation costs?

Whether your company does the job or you contract for it, there are opportunities for reducing the costs of installing your large transformers

Do you know that some utilities have paid as much as $4500 just to install a large power transformer? And that installation costs on two similar units at the same station—but made by different manufacturers—have differed by as much as 156 per cent? Such differences almost always stem from the design of the transformer itself.

YOUR COMPANY MIGHT SAVE thousands of dollars during the next few years if you could evaluate various transformer designs for installation cost before you buy.

One way to evaluate in advance is to compare the proposition drawings of a number of manufacturers. Differences are often quickly apparent—showing which design offers you the fastest, most economical installation.

IF YOU CONTRACT for your installation work, you can submit transformer proposition designs to your contractor. His estimates will reflect the differences that mean more—or less—money for time, labor, and equipment.

Thousands of dollars were saved on power transformer installations last year. How it was done is told in the photo report on the following pages.

P·G·and·E

GENERAL ELECTRIC

Every G-E transformer shipped upright

INSTALLED IN LESS TIME, AT LESS COST

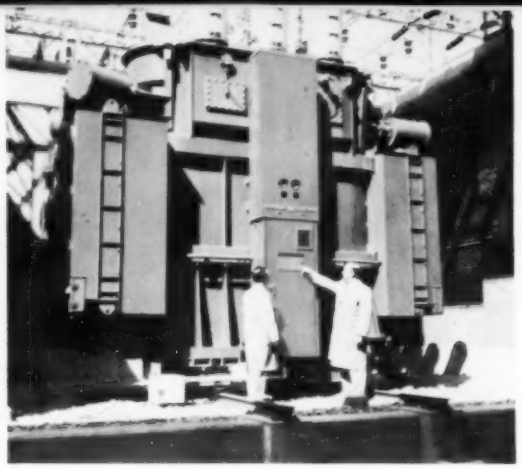
Electric utilities like the 21 whose emblems are shown here report installation savings ranging from $500 to $4500 per transformer

Here's how they saved. Their G-E transformers were delivered upright at the site . . . ready to slide off the flatcar onto the foundation without difficult maneuvering to upright them. They were shipped in one piece, almost completely pre-assembled, and with most accessories pre-wired. This saved more time and further cut installation cost.

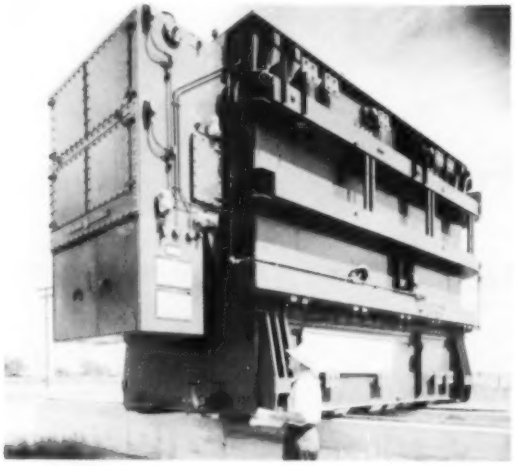
G-E Concentric-winding construction makes it possible to build a complex high-capacity transformer into a compact tank. That's why G-E transformers come to you upright, in one piece, and nearly completely assembled. It makes possible the easy, economical installations pictured on these pages, and makes it worth your time to compare transformers for installation costs *before* you buy.

Progress Is Our Most Important Product

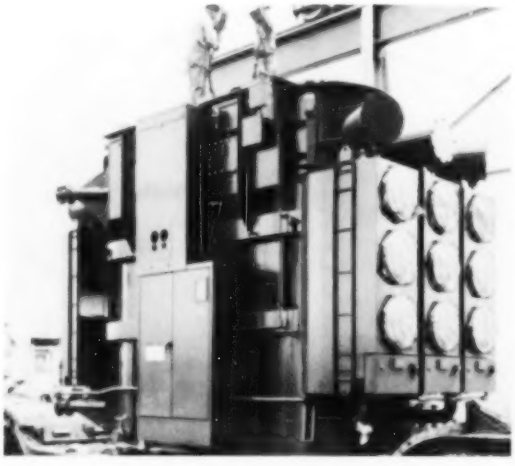
GENERAL ELECTRIC



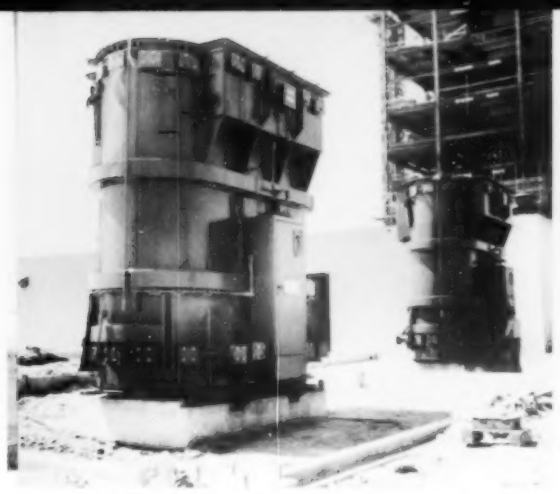
Potomac Electric Power Co.'s 90,000-kva transformer took only 300 man-hours to ready-for connection.



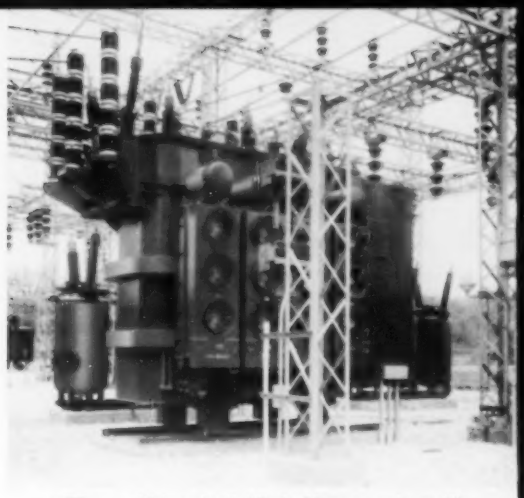
Houston Lighting and Power Co. installed this 50-mva unit in less than three eight-hour days, at big savings.



Only two days' working time were required to unload and place this 150-mva unit at Dallas Power and Light's Mountain Creek Station.



These 50,000-kva G-E transformers were installed in ten days at San Diego Gas & Electric Co.'s Encina Power Plant.

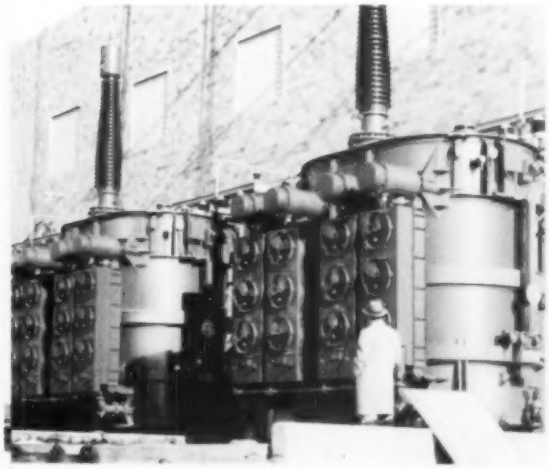


Shipped oil filled, 50-mva unit at Nebraska Public Power System was ready to energize 2 ½ working days after location.

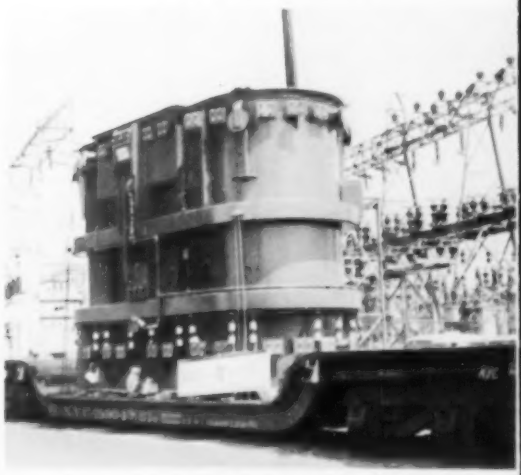
P·G·&E·

These 61,250-kva transformers were installed at Pacific Gas & Electric Co.'s Pittsburg steam plant in five days each.

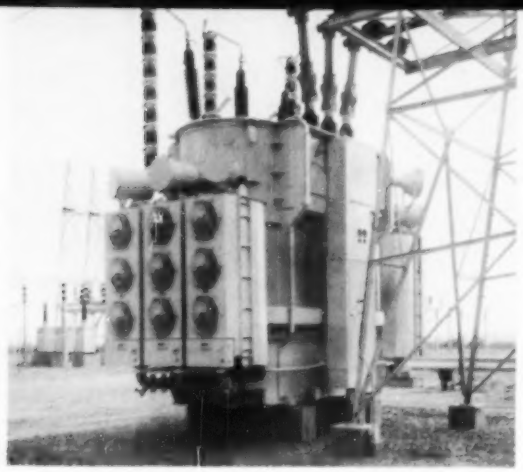
Power transformer rated FOA-T-75,000 is installed at Pennsylvania Power and Light Co.'s Hummelstown station.



These 80,000-kva, 330-kv forced oil-air-cooled units are installed at Ohio Valley Electric Co.'s Kyger Creek plant.

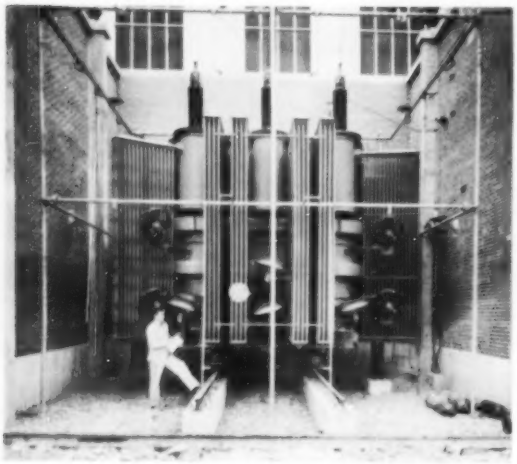


This 140-mva unit arrived at Jersey Central P & L Co.'s Raritan River Station upright, ready to be slid into position.

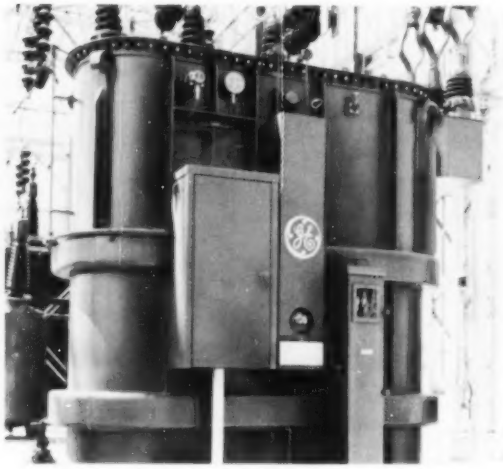


Unit coolers shipped in place on this 140-mva unit saved one day of installation work for Arizona Public Service Co.

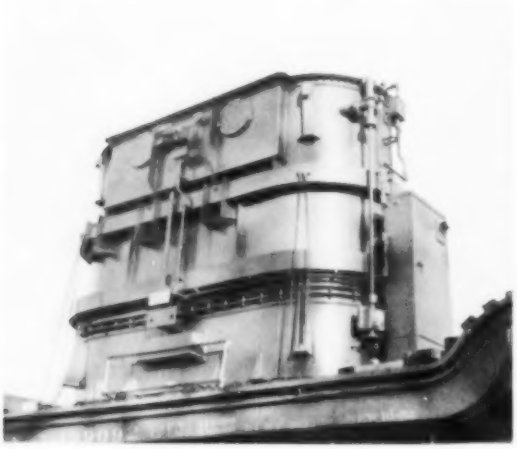
These 45-mva transformers at Etiwanda steam station of Southern California Edison Co. were shipped upright.



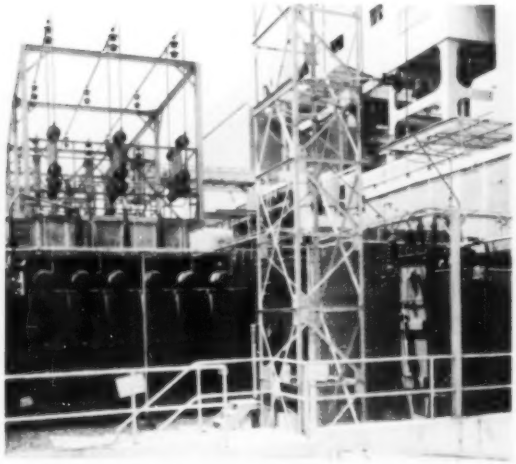
Upright shipment of this transformer at Urquart Station, South Carolina Electric & Gas Co. simplified the rigger's job.



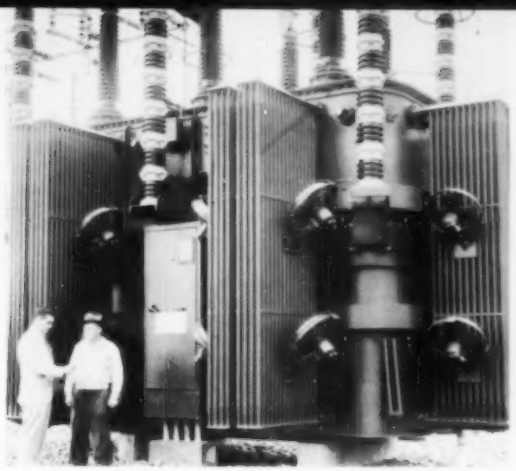
This 50-mva unit was on its base and oil-filled 3½ days after arrival at Empire District Electric Co., Riverton, Kansas.



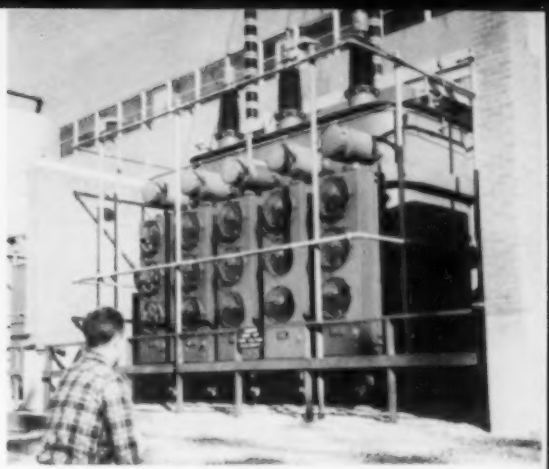
Alabama Power Co.'s 160,000-kva unit arrived upright on flatcar, ready to slide into position at Barry Steam Station.



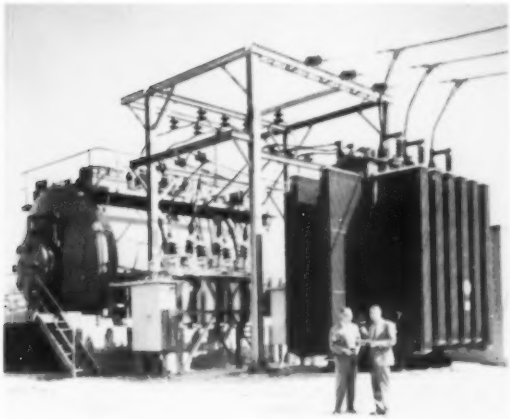
Long Island Lighting Co.'s Glenwood transformers, FOA-T-125,000, were transported to the site by river barge.



This 100,000-kva transformer was delivered to Kentucky Utilities' Green River Station upright in a one-piece tank.

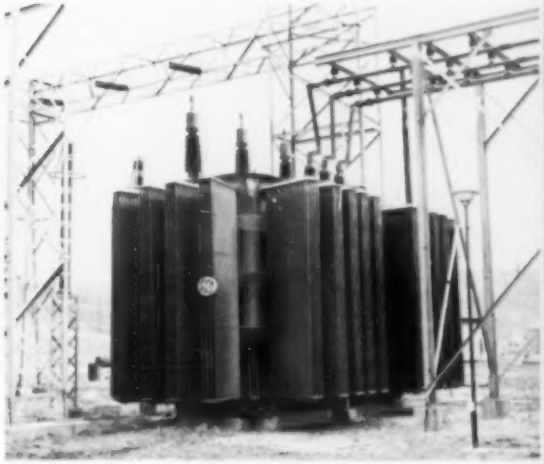


This 84,000-kva transformer is installed at Central Hudson Gas and Electric's Danskammer Point Steam Station.

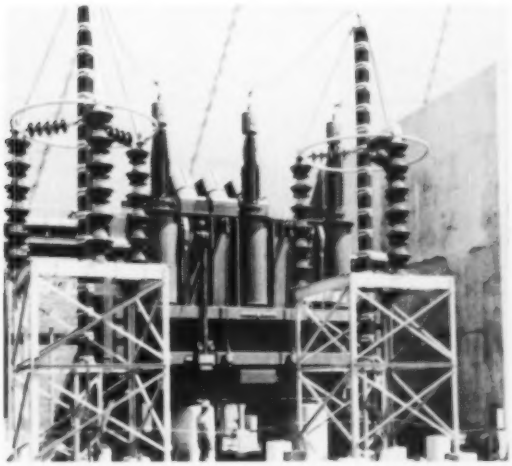


DETROIT EDISON

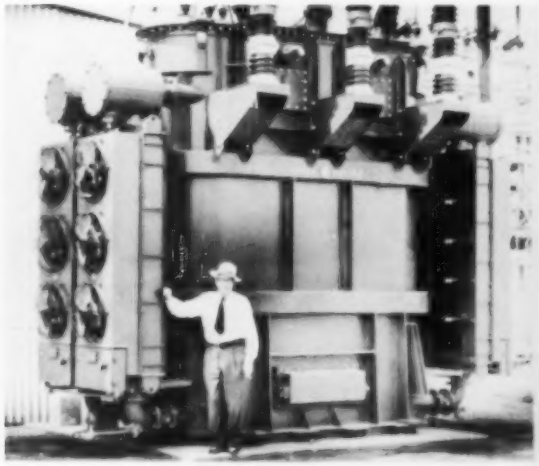
This 48,000–60,000-kva unit, at Detroit Edison Company's Jefferson substation, supplies a steel plant.



New G-E 75,000-kva transformer located at the Poston station of Columbus and Southern Ohio Electric Company.

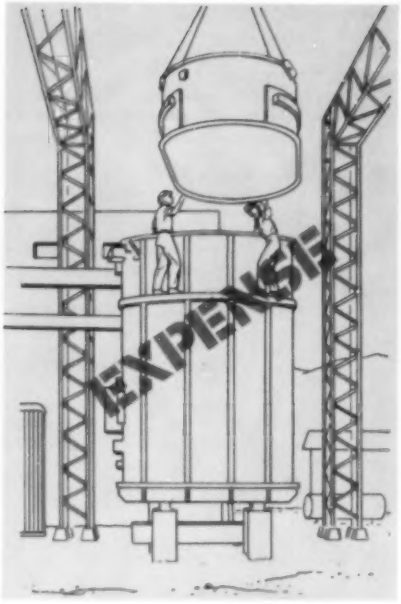


With unit coolers mounted, this 120,000-kva unit for Public Service Co. of Indiana was shipped with all accessories on one flatcar.

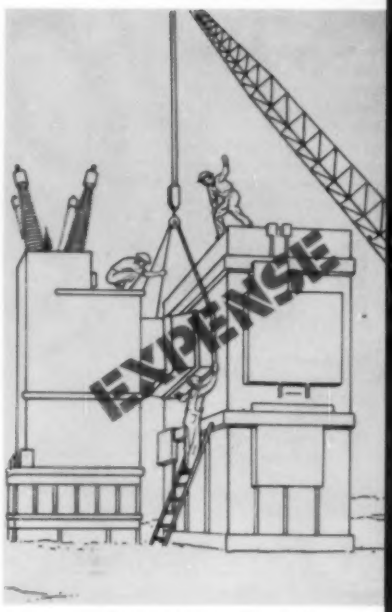


The Tucson Gas, Electric Light and Power Co. was pleased with the high degree of pre-assembly of this 75,000-kva power transformer.

TIPPING UP



INSTALLING TOP TANK SECTION



COMPLICATED ASSEMBLY

G-E POWER TRANSFORMERS ELIMINATE THESE COSTLY STEPS

You can save thousands of dollars with G-E power transformers because expensive installation steps are eliminated. There is

No tipping upright because G-E transformers are always *shipped* upright, eliminating the heavy rigging equipment and material which are needed to upright transformers shipped on their sides.

No top-tank section to install because G-E transformers are shipped in one-piece tanks with their own covers already on. There is no temporary cover to unweld, no long joints to clean for welding, no separately shipped tank section to be assembled and welded in the field. On a recent installation, G-E one-piece tanks saved over 288 man hours on this operation alone.

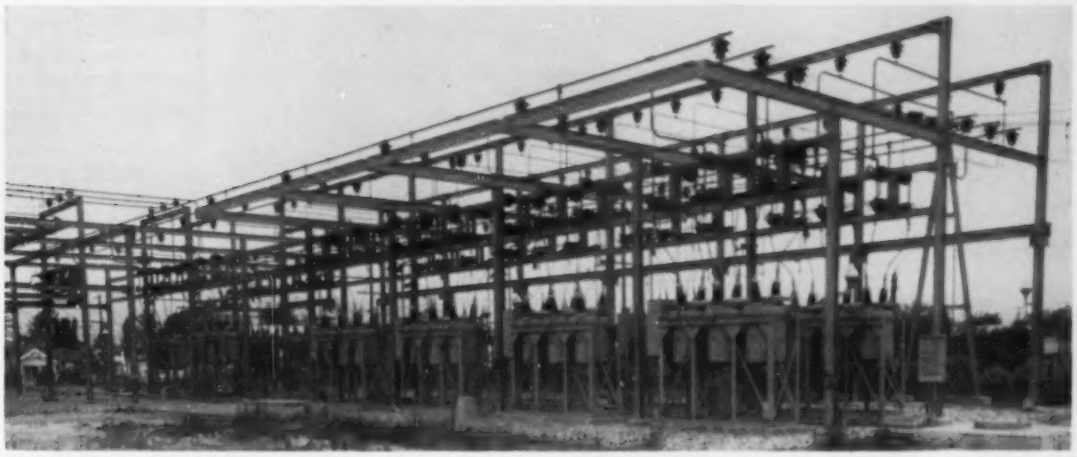
No separate tank to line up because G-E design includes series transformers inside the main tank; and load-tap-changers and unit coolers are often shipped in place, completely assembled. Maximum factory assembly means minimum field assembly and does away with the costs of moving heavy rigging equipment long distances to installation sites.

Only four steps are required to install any large G-E transformer. First, slide the unit off the flat-car and onto its foundation (truck winches will do it). Second, install accessories. Third, fill with oil. Fourth, connect to line and energize.

For full information about G-E power transformers, see your G-E Apparatus Sales Engineer, or write Section 421-37, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



WIDE-FLANGE ROLLED STEEL structural members are used to make rectangular interconnected rigid frames for 34.5-kv switchracks. This new design costs about 25% less than laced steel structures and is easier to erect and maintain

SUBSTATIONS—Design

Rolled Steel Shapes Cut Switchrack Costs

K. S. FIETINGHOFF and **MAX W. STRAUSS**
Design Engineers, Department of Water & Power, Los Angeles, Calif.

New designs of wide-flange steel members for 34.5-kv and 138-kv switching structures are helping to hold costs down for Los Angeles Dept of Water & Power. The new designs are about 5% lighter and cost about 25% less than the laced structures previously used. Additional advantages include decreased erection time, simplicity of maintenance, accessibility of equipment, and enhanced appearance.

Need for a better design grew with the post-war increases in the cost of fabricating, galvanizing, and maintaining the laced structures. The problem of painting assumed greater importance with an unexpectedly high rate of deterioration of exposed galvanizing.

The new designs resulted from a preliminary cost study of the simplest type of rigid frame that could be adapted to the basic functional electrical requirements. The simplified 34.5-kv switchrack employs a series of rectangular interconnected rigid frames. The 138-kv rack consists of a number of A-frames.

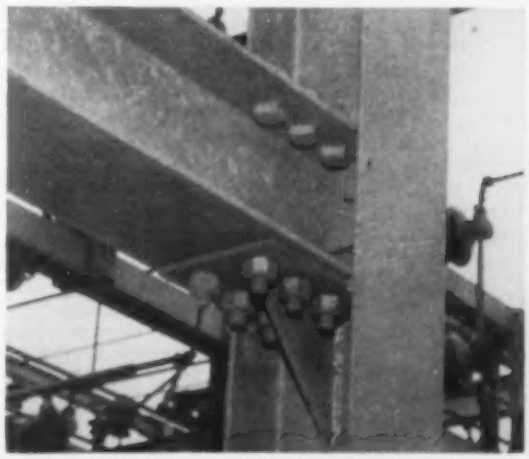
In both cases, use of wide-flange rolled shapes has reduced the amount of punching required and the number of parts and sub-assemblies. With additional savings resulting from greatly simplified erection, solid members are being used for all types of racks and equipment supports.

Frames of the 34.5-kv racks have about an 18-ft span and heights up to 41 ft. Continuity is achieved through use of simple moment connections. These consist of a beam seat continuously shop welded to the column, prior to galvanizing, and a top connecting member field bolted to columns and beams.

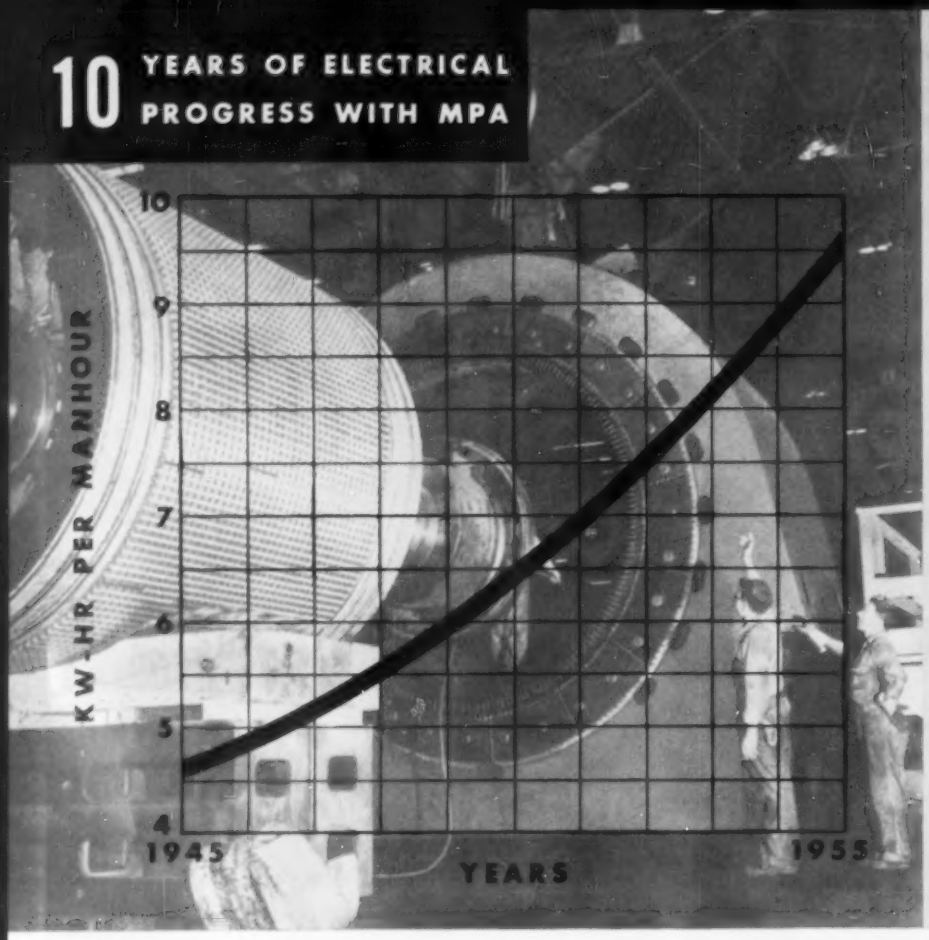
Structural analysis of the frames for gravity and pull-off loading was made by the conventional method of moment distribution. The method utilized principles of superposition developed by Prof. D. M. Wilson, University of Southern California.

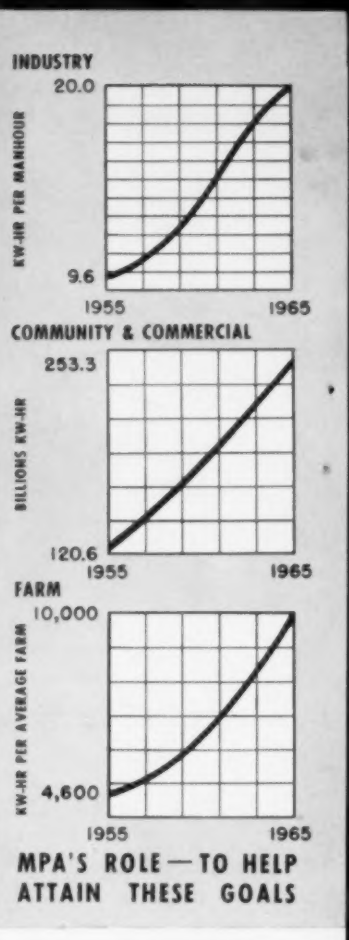
A-frames for 138-kv racks range in height from 50 to 70 ft and are spaced 42 to 55 ft apart. A horizontal girder connects the A-frames at their tops and serves as a trans-

(*Continued on page* 126)



FIELD BOLTING of new switchracks is held to a minimum. A simplified erection process allows the solid members to be used for all racks and equipment supports





Stimulate growth of your electrical load with these 22 General Electric MPA film programs

"More Power to America" marks tenth year as dynamic load-building tool

Ten years ago, spurred by a desire to help accelerate expansion of the electrical industry, General Electric launched the "More Power to America" program. Designed to help you increase industrial, farm, and community electrification, MPA features dramatic film programs as mass market development media.

The last decade has seen MPA—with the help and encouragement of America's utilities—become an effective, long-range load-building and training tool. Five vital areas of interest—including industrial electrification, community development, rural electrification, training, public relations—are well covered by the 22 films now available. Kilowatt-hours per production manhour have more than doubled during the first ten years of MPA. And looking to the ten golden years ahead, G.E. pledges to help you achieve even more ambitious gains in community, farm, and industrial electrification. Important new programs are being readied for release and long range plans call for many more in the next ten years.

Programs consist of motion picture or slidefilm, a manual, and supplementary literature. Non-commercial in nature, each film portrays the latest electrical ideas and techniques in the use of electric power.

Nationwide, utilities are using MPA's creative, mass-selling methods for stimulating constructive action. For purchase details or a preview of these programs contact your G-E Apparatus Sales Office, or mail coupon to General Electric Co., Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Sewage Treatment

Water Supply

Outdoor Recreation

Urban Transit

Street Lighting

Electrified Farming

Farm Water Supply

Barn Hay Curing

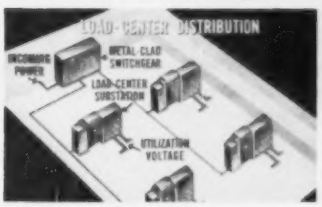
Dairy Electrification

Resistance Welding

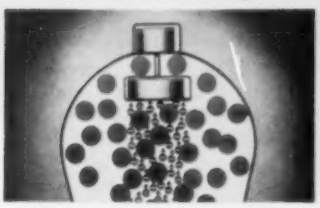
Materials Handling

Laundry Electrification

Textiles



Industrial Power Distribution



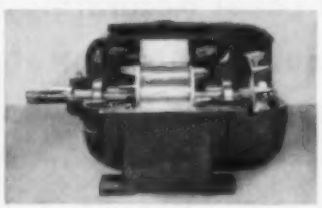
Electronic Training Course

Electric Arc Welding

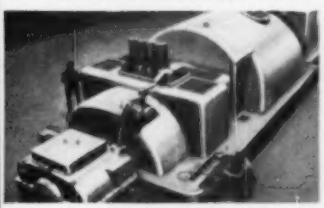
Industrial Heating

Progressive Mechanization

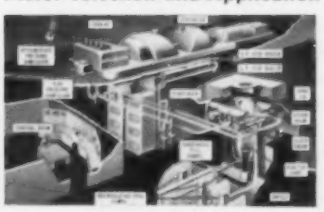
Oil Field Electrification



Motor Selection and Application



Freedom and Power



Atomic Power

CHECK PROGRAMS AND MAIL TODAY

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY
APPARATUS SALES DIV., SEC. B350-1
SCHENECTADY 5, N. Y.

I am interested in the following film programs:

√ for purchase details × on a loan basis

- ☐ Sewage Treatment (25-minute, 16-mm motion picture) $195
- ☐ Outdoor Recreation (20-minute, 16-mm motion picture) $35
- ☐ Water Supply (25-minute, 16-mm motion picture) $170
- ☐ Urban Transit (17-minute, 16-mm motion picture) $150
- ☐ Streetlighting (26-minute, 16-mm motion picture) $75
- ☐ Barn Hay Curing (28-minute, 16-mm motion picture) $160
- ☐ Farm Water Supply (20-minute, 16-mm motion picture) $160
- ☐ Electrified Farming (20-minute, 16-mm motion picture) $175
- ☐ Dairy Electrification (27-minute, 16-mm motion picture) $165
- ☐ Laundry Electrification (30-minute, 35-mm slidefilm) $15
- ☐ Electronics Training Course (Twelve 20-30 minute, 35-mm slidefilms) $150
- ☐ Resistance Welding (30-minute, 16-mm motion picture) $190
- ☐ Power Distribution (20-minute, 35-mm slidefilm) $25
- ☐ Oil Field Electrification (30-minute, 16-mm motion picture) $200
- ☐ Materials Handling (24-minute, 16-mm motion picture) $175
- ☐ Electric Arc Welding (27-minute, 16-mm motion picture) $200
- ☐ Textiles (26-minute, 16-mm motion picture) $200
- ☐ Industrial Heating (30-minute, 35-mm slidefilm) $15
- ☐ Motor Selection and Application (Ten 10-30 minute, 35-mm slidefilm) $100
- ☐ Progressive Mechanization (27-minute, 16-mm motion picture) $200
- ☐ Freedom and Power (29-minute, 16-mm motion picture) $200
- ☐ Atomic Power (15-minute, 16-mm motion picture) $100

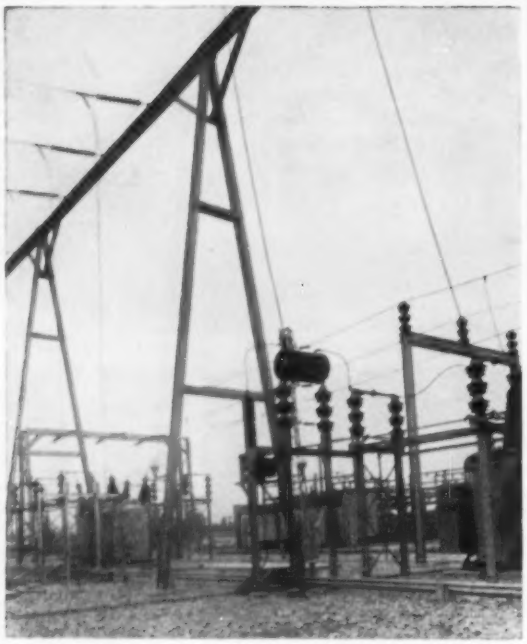
NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....



A-FRAMES FOR 138-KV RACKS range in height from 50 to 70 ft and are spaced 42 to 55 ft apart. Horizontal girder transmits lateral "pull-off" forces between A-frames

Rolled Steel Shapes for Switchracks

(*Continued from page* 123)

mitting member for lateral "pull-off" forces. Stability in the plane normal to the A-frames is provided by knee braces from the horizontal girder to the vertical frame.

In resisting horizontal loads, except for minor secondary stresses and regardless of the condition of fixity at the top of the footing, the legs of the A-frame are subject only to axial stresses. With the lateral load applied at the apex of the structure, one leg of the frame is subject to permanent tension while the other is in compression.

This allows use of light horizontal compression struts which provide the needed lateral support for the compression leg. Thus, a rolled section may be turned to take full advantage of its stiffness about the major axis. At the same time, maximum use may be made of available stiffness about the minor axis.

The A-frame principle is used in the design of deadend bus supports as well as 138-kv racks.

To reduce construction costs, all footings for both the 34.5-kv and 138-kv structures are pole-type piers. They are cast in auger-bored holes to eliminate costly excavation and formwork. Resistance to horizontal shear existing in the superstructure is provided by the passive resistance of the soil.

Development of the rigid frame racks required unusually close cooperation between the electrical and structural designers.

DISTRIBUTION—Construction

Modified Level Accurately Plumbs Ornamental Street-Light Standards

H. B. FULLER, Indiana & Michigan Electric Co, Elkhart, Ind.

A tool for plumbing ornamental street-light poles having different tapers has been developed in this district of Indiana & Michigan Electric Co. The tool assures more accurate plumbing, and a foreman doesn't cross a busy street to sight by eye.

The tool utilizes a carpenter's level clamped between 8-ft pieces of plywood having adjustable shoes at each end to fit different tapers. The shoes are semicircular and cut to fit the radius of the poles at the bottom and 8 ft up. A hole at eye level in both pieces of plywood permits viewing the bubble.

The tool cost about $4.50 for material excluding the level and required two man-hours to make.

Small Pole, Transformer Facilities Save Time

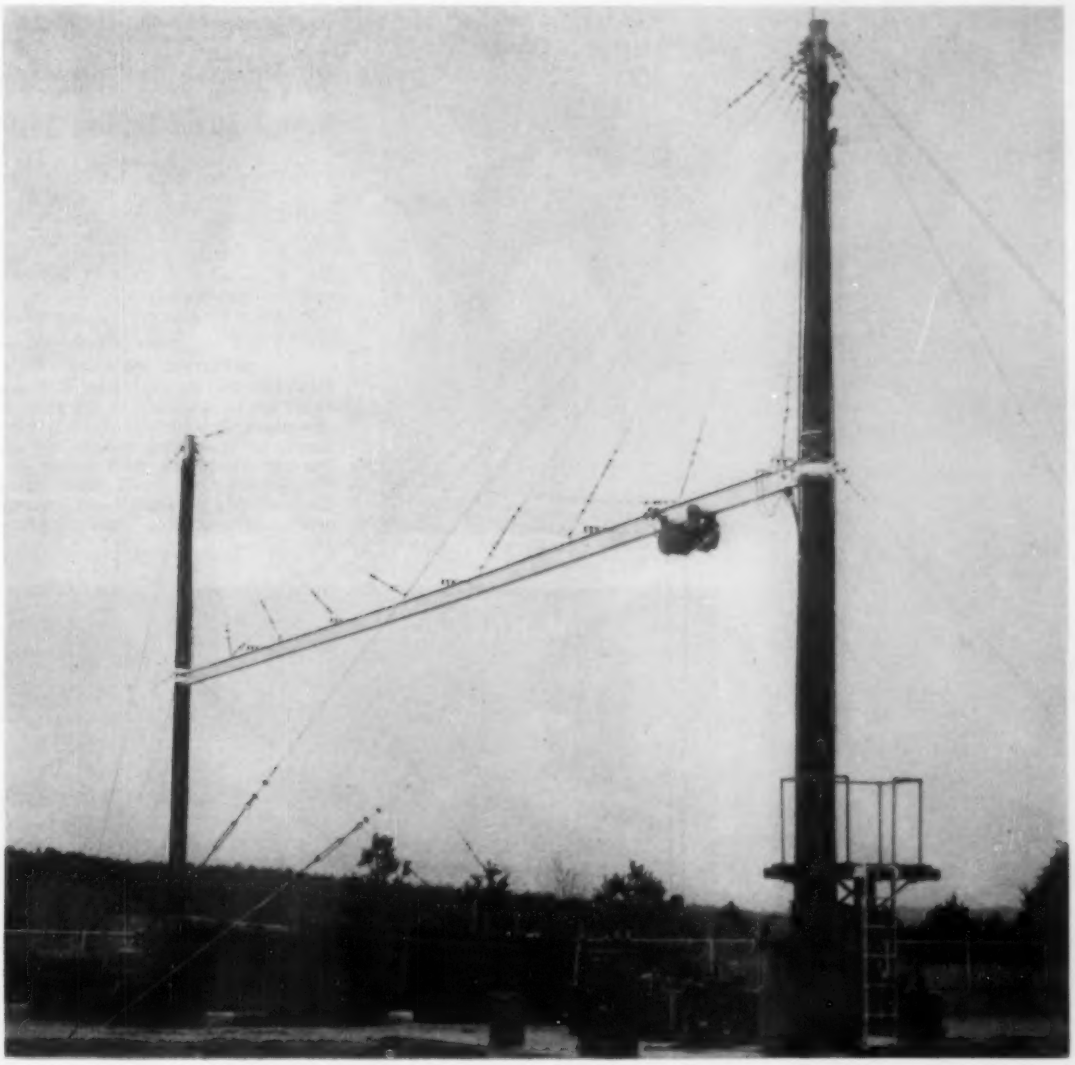
JUDSON WEBB, Asst Supt of Distribution, Birmingham District, Alabama Power Co, Birmingham, Ala.

Pole and transformer handling facilities have been designed by Alabama Power Co for small crew headquarters. With proper scheduling, the facilities can be used by four or five crews to handle up to 60-ft, class 2 poles and 1½-ton equipment quickly and easily. Several travel hours a day per crew are eliminated. Many unsafe factors involved in loading and unloading poles manually are eliminated.

Main item at the storage area is the electrically operated traveling crane. It consists of a 1½-ton hoist operating on a 10-in., 25.5-lb I-beam between two 50-ft poles set 76 ft apart. The beam, suspended from the top of the poles by cables, has floating attachments at either end to avoid the use of high-strength clamps. The ⅜-in. HS cables which carry the total weight, run from steel caps on the poles to nine points on the beam.

At the two points on both ends of the beam the cables are secured to turnbuckles which are attached to beam clamps. At all other points the cables run freely from one pole cap to the other through inverted suspension clamps attached to beam clamps. Turnbuckles are cut in these cables for leveling the beam. Both poles are guyed with seven ⅜-in. cables.

(*Continued on page* 134)



A G-E PROGRESS REPORT

ON THE RISING

TREND TO FLUORESCENT

More Progressive Cities Adopt Newest Street Lighting Source

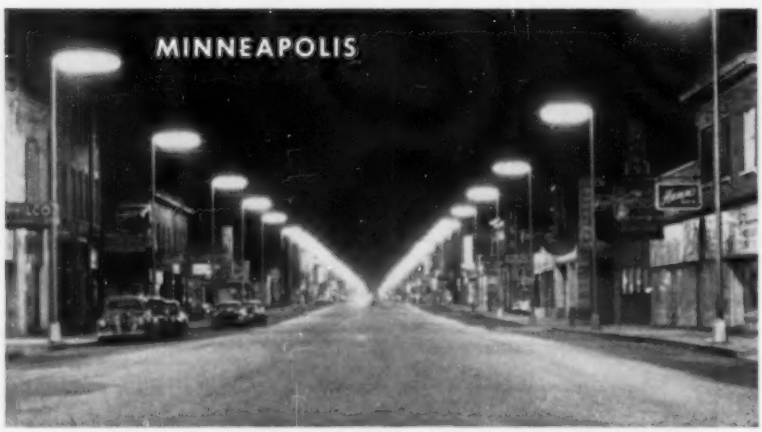
Five years ago General Electric introduced fluorescent street lighting to the United States. Today, thousands of these new luminaires are in service all over the nation. Fluorescent's growth rate is higher than that of any other outdoor lighting source.

What are the reasons for this unusually rapid growth?

IMPROVED VISIBILITY

Doubtless the leading cause of fluorescent's rise to popularity is the great improvement in visibility which it brings about. Some lighting experts say that you see about one third better on a fluorescent-lighted street than on one illuminated to the same level by mercury or filament luminaires. This improvement

NATION'S LARGEST fluorescent street lighting installation is inspected by Minneapolis officials. Flanked by G-E sales manager John Pike and lighting specialist Ernest Wendling, Minneapolis aldermen Frank V. Moulton, George E. Johnson, Jr., and George W. Martens watch installation of Form 206 luminaire.



3.3 MILES of Lake Street now have maintained illumination level of 1.5 foot-candles from G-E fluorescents. 500 of these units have been placed in service in this important business area. Installation is part of city-wide lighting expansion program.

"RECEIVED ONLY FAVORABLE comments on the new lights" says J. W. Monk, Dallas public utilities supervisor. Travis Winter, Dallas P&L, worked with Mr. Monk in obtaining decision to install more than 300 fluorescents in downtown Dallas.

EXCEPTIONAL "SEE-ABILITY" characterizes Lexington Street, Baltimore, under its new General Electric fluorescent street lighting. City and Baltimore Gas and Electric Company are also progressively relighting other areas.

is due to (a) reduced luminaire brightness, (b) improved pavement brightness uniformity and (c) excellent color quality from the "cool white" fluorescent lamp.

PLEASANT, "COOL-WHITE" LIGHT

There's no distortion of colors from the "cool white" light of fluorescent lamps. People's complexions and clothes, familiar objects, etc., look the same under this comfortable light as under sunlight.

MODERN APPEARANCE

The distinctive lines, up-to-date design, and functional beauty of the General Electric Form 206 luminaire make it an asset to any street's appearance.

LOWER MAINTENANCE

The average effective life of a fluorescent street lighting lamp is about two years! The hinged plastic globe enclosing the lamps is shatterproof. Neither the globe nor the light output is unduly affected by sun, rain, heat, cold, dirt, or aging.

LOWER COST

Compared on the basis of judged equivalent visibility with either color-improved mercury or filament, the G-E Form 206 fluorescent luminaire costs less than these other systems! While fluorescent equipment and amortization costs usually are somewhat higher, installation costs are about the same and operating and maintenance costs are generally lower.

MORE INFORMATION?

You can get complete information on the Form 206 fluorescent luminaire from your nearest G-E Apparatus Sales Office, agent, or distributor. Or, write Section 452-161, Outdoor Lighting Dept., General Electric Co., 1400 Western Ave., West Lynn 3, Mass.

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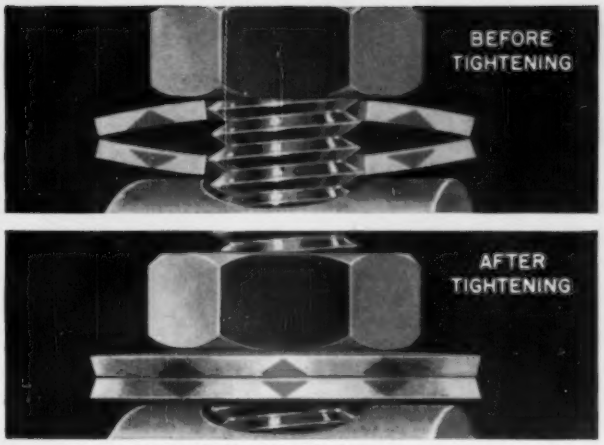
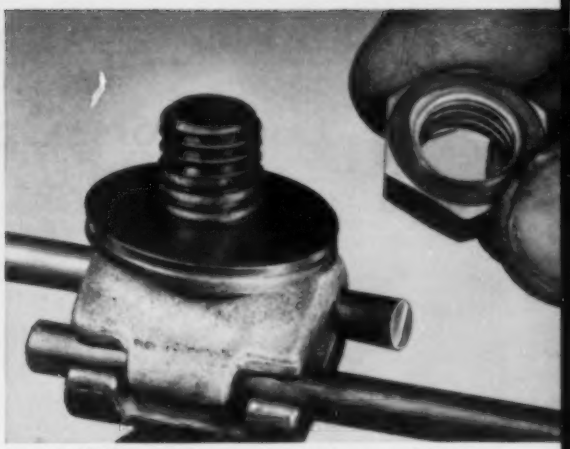
"ABSOLUTELY THE BEST" said S. Ivan Sandberg, of San Francisco's Department of Public Works, about the General Electric Form 206 luminaire. Intersection above is near famed Golden Gate Park.

"PAVEMENT GLARE IS REDUCED on Lexington Avenue during rainy or foggy weather" according to Armand D'Angelo, N. Y.'s Deputy Commissioner of Water Supply, Gas and Electricity.

DEMONSTRATION OF CLAMPING ACTION of G-E Capacitor Terminals shows how Belleville washers flatten after proper wrench torque—maintain 1000-lb pressure. Aluminum and/or copper conductors are held securely even if "cold flow" should occur.



1000-LB SPRING ACTION through compression of Belleville washers. Flattened washers indicate sufficient torque.



STUD STRIPPING ENDED with easy-to-replace nut which strips first if too much torque is applied.

G-E CAPACITOR TERMINALS MAINTAIN LASTING CONTACT

Field-proven assembly compensates for "cold-flow" and eliminates terminal stud stripping

Quick, lasting connections can be made with G.E.'s capacitor terminal assembly. Linemen need only *flatten* the stainless steel Belleville washers with about 2 turns on the nut to securely clamp aluminum or copper conductors. That's because these washers convert 8 ft-lbs of torque to approximately 1000 lbs force on the parallel groove connectors. They also provide a "follow-up" action that compensates for aluminum "cold-flow," thereby maintaining lasting contact pressure.

STRONGEST ASSEMBLY on the market today, the G-E capacitor terminal stud has been subjected to tightening torques of over 70 ft-lbs without damage. If excess torque is applied, the threads on the nut, which has been designed as the weakest member of the assembly, will strip before those on the stud.

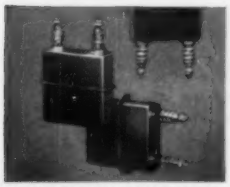
WIDE RANGE OF CONDUCTORS (AL/CU) from No. 2 to No. 9 AWG (stranded) or No. 10 AWG (solid), can be securely clamped with G.E.'s parallel groove connector. A conductor can be easily inserted without threading or removing any hardware.

ENGINEERED EXTRAS such as this new terminal combine to make General Electric capacitors the most practical . . . and economical unit for you. For complete information about them, contact your G-E Apparatus Sales Representative or write for bulletin GEA-6260, General Electric Company, Schenectady 5, New York. 441-28

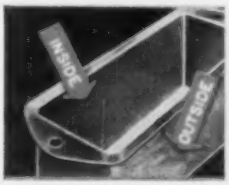
Progress Is Our Most Important Product

GENERAL ELECTRIC

ONLY G-E CAPACITORS HAVE ALL THESE *Engineered Extras* AT NO EXTRA COST

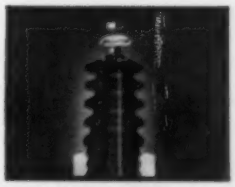


MOUNTED IN ANY POSITION G-E capacitors maintain uniformly high efficiency.



CORROSION-RESISTANT CASE, tin plated inside and outside, prolongs capacitor life.

SMALLER AND LIGHTER, than any other make, for easiest handling and installation.



EXTRA-STRENGTH BUSHINGS, welded then soldered to case, maintain hermetic seal.

Series Capacitors, Operation and Applications

R. E. MARBURY and ZENO NERI, Switchgear Distribution Apparatus Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.

Where the purpose of the series capacitor is to reduce voltage drop, the following principle applies.

1. Voltage drop in one phase of a circuit having lagging power factor load may be computed as follows:

$$(E_s - E_r) = (IR \cos\theta + I X_L \sin\theta) + j\,(I X_L \cos\theta - IR \sin\theta)$$

Where: E_s = sending end voltage; E_r = receiving end voltage; R = total circuit resistance; X_L = total circuit inductive reactance; I = load current; θ = power factor angle of the load.

Quadrature component ("j" term) of the voltage difference usually can be neglected because it causes phase shift between sending and receiving end voltage but negligible voltage drop. With this simplification the equation becomes:

2. Voltage drop without series capacitor:

$$E_s - E_r = IR \cos\theta + I X_L \sin\theta$$

From this expression it is easily seen that with a high power factor load (cos θ large, sin θ small), resistance drop in the circuit is a large portion of total drop and reactance drop is of little consequence. In such cases, a series capacitor is usually not effective. If, however, power factor of the load is low (cos θ small, sin θ large), voltage drop caused by inductive reactance becomes appreciable, particularly if X_L is large, and a series capacitor may be used to advantage. See accompanying vector diagrams.

3. Voltage drop, with series capacitor in circuit, is:

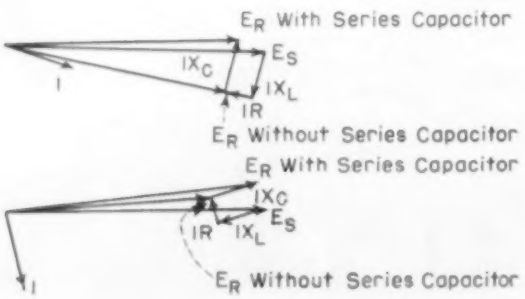
$$E_s - E_r = IR \cos\theta + I (X_L - X_c) \sin\theta$$

If capacitor reactance (X_c, ohms) is made equal to the inductive reactance of the circuit, there will be no steady state reactive drop and the circuit will behave essentially as if only resistance was present.

If load power factor is low and nearly constant for all values of load current, the reactance of the capacitor may be made greater than the inductive reactance of the circuit to compensate for part of resistance drop in the circuit.

To compute the over-all performance that may be realized from installation of a series capacitor, it is first necessary to know the constants of the circuit. Resistance of the conductors can be obtained readily from an engineering handbook. Inductive reactance for various circuit structures can also be obtained from an electrical engineering handbook. Impedance of transformers can usually be obtained from the nameplate or from the manufacturer.

Computing resistance and reactance may be complicated somewhat if there is one or more transformers in the circuit. In such a case equivalent resistance and reactance of each line section and each transformer should be referred to the same voltage level as the line section in which the capacitor is to be placed. This is done by multiplying each resistance and reactance by the square of the ratio of line voltage of the section to contain the capacitor to line voltage of the section being computed.



Data Required for Larger Series Capacitor Applications

1. Ohms per phase, X_c.
2. Continuous sustained line current.
3. Maximum momentary current for which protective gap shall not operate (needed especially for non-automatic devices).
4. Maximum fault current (without series capacitor).
5. Maximum duration of fault current.
6. System voltage.
7. Type of protection.
   a. Manual re-insertion.
   b. Automatic re-insertion (usually not practical on series capacitor smaller than 300 kvar per phase because of cost).
   c. Instantaneous re-insertion (usually not required on less than 10,000 kvar and unless system stability is involved).
8. Over-all purpose of series capacitor.

Applications of Series Capacitors

A. Voltage Dip Elimination. Place in distribution transformer primaries to cancel part or all of line reactance, thus reducing voltage dips caused by (1) motor starting loads and (2) welder kva.

B. Line Reactance Matching. Place in high-reactance line to cancel reactance and thus control division of current. In case of parallel lines having different reactance values division of current may be unsatisfactory from the standpoint of line current-carrying capacity.

C. Power Transmission Improvement. Place in supply line to increase power that may be transmitted or to permit transmission of the same power over a longer line; power transmitted is determined in many cases by stability limits, which in turn are governed by line reactance.

Application Checks

1. Select the basic rating sufficiently high with respect to instantaneous load currents to avoid operation of protective devices by momentary loads.

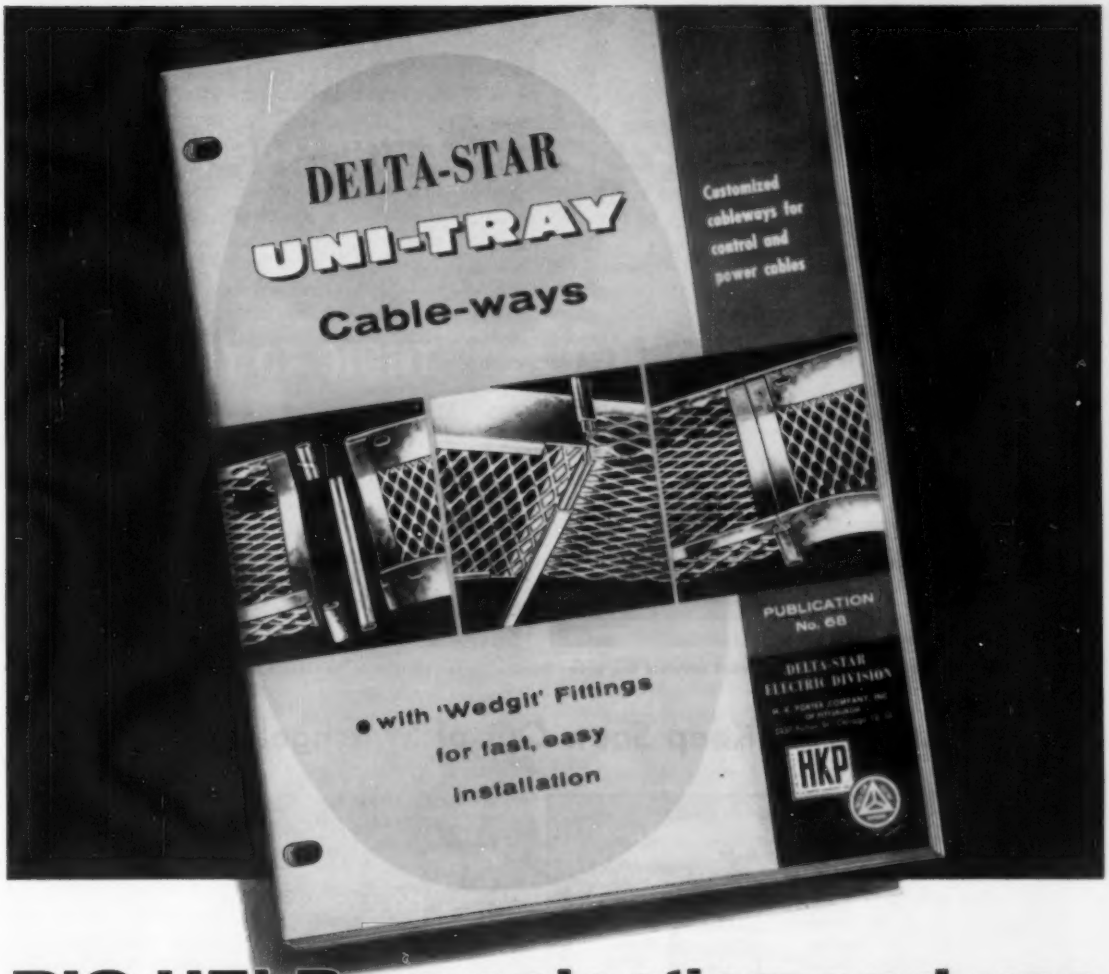
2. Eliminate resonance during motor starting by shunting series capacitor with a resistance.

3. Avoid boosting transformer voltages into non-linear range where resonance effect may be troublesome.

4. Make detailed study of system loads to predict effect of a series capacitor on system operation.

Series capacitors are not applied with the same ease as shunt capacitors because they modify characteristics of entire circuit and can only be successfully dealt with in terms of system performance. Addition of loads anywhere on the system may change the over-all operation.

Series Capacitor Ratings will appear in an Engineering Reference Sheet in a forthcoming issue of Electrical World



BIG HELP on selection and use of UNI-TRAY CABLE-WAY

Here's a brand new Delta-Star UNI-TRAY Catalog. It helps save you time and money on cableway installations.

This 20-page booklet covers UNI-TRAY applications, gives selection and installation help, and lists all sections and fittings in the line.

The UNI-TRAY Cable-Way system using 'Wedgit' Fittings for joining sections reduces by 75% the time required to make up bolted joints. Improved electrical characteristics are inherent.

Just ask or write for your copy of the UNI-TRAY Catalog. For quick response, use the coupon.

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Delta-Star Electric Division
H. K. Porter Company, Inc.
2437 Fulton St., Chicago 12, Ill.

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DELTA-STAR ELECTRIC DIVISION

HKP

H. K. PORTER COMPANY, INC.
2437 Fulton Street · Chicago 12, Illinois
District Offices in Principal Cities

Pole Handling Facilities

(*Continued from page* 127)

An elevated platform and pushbutton station are provided at the base of one pole for operating the hoist. From this out-of-the-way position, the operator has a complete view and can control electrically movement of both the hoist and its hook.

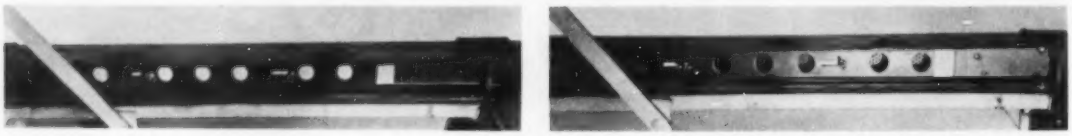
Space between the two upright poles of the crane is for pole and transformer storage and a 14-ft driveway. Poles rest on three reinforced concrete racks having 3-in. sockets for spacer pipes. The center rack is 40 ft long and placed directly below and in line with the I-beam. The other two racks are spaced 19 ft from the center rack at one end and 12 ft away at the other. This tapered arrangement provides support for poles up to 60 ft long.

Across the driveway from the pole facilities is a transformer storage area. This consists of a 15 x 20-ft reinforced concrete mat, 5 in. thick, sloped for drainage.

At those locations where crew headquarters have rail facilities available, the transformer mat is eliminated. Rail siding is constructed under the hoist beam at one end of the pole racks and a truck drive at the other end.

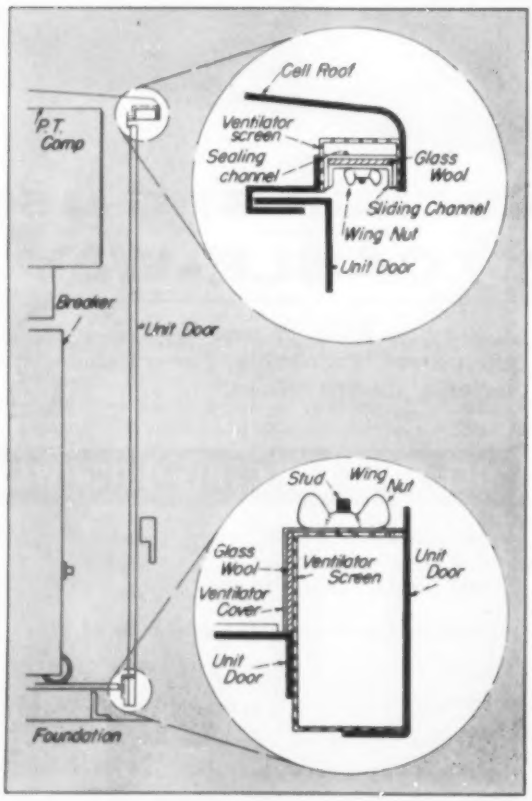
Completed facilities cost approximately $6,000. They required about 50 manhours for erection, excluding concrete work.

SUBSTATION—Maintenance



LOOKING UP under overhang of the roof reveals the cover for the upper ventilator in closed and open positions

Ventilator Covers Keep Snow Out of Switchgear



T. M. SHOEMAKER, Supt, Substation Div.,
K. R. ANDERSON, Engineer, Iowa Illinois Gas & Electric Co, Davenport, Iowa

Movable covers have been installed on ventilators in outdoor metal-clad switchgear by Iowa Illinois Gas & Electric Co to keep driving snow out of the switchgear. During the summer the covers are opened to provide cooling for satisfactory operation.

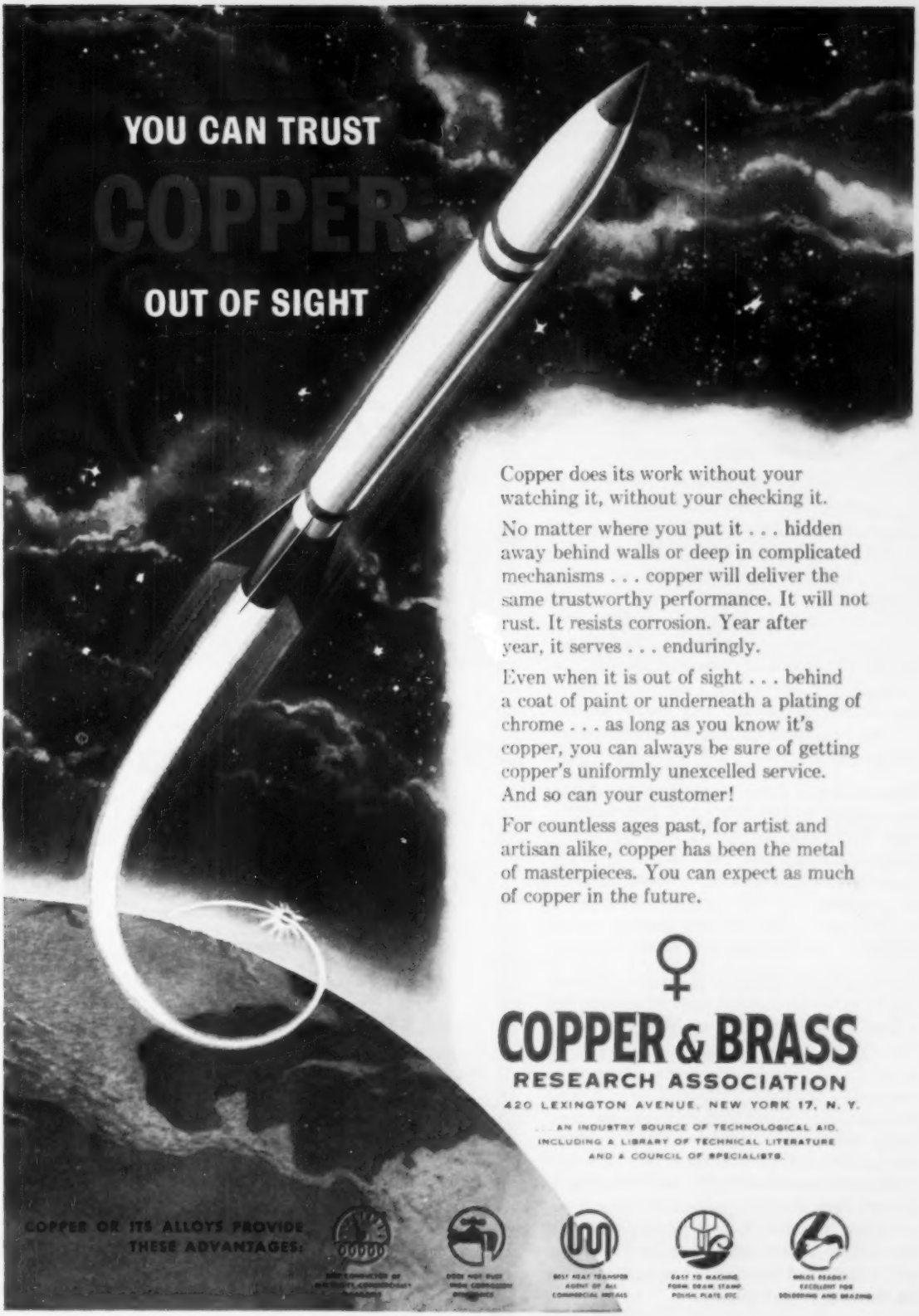
The covers are installed over both the lower ventilator attached to the door and the upper ventilator under the overhang of the roof. Both ventilators, made of perforated sheet metal, are channel shaped and welded in place.

For the lower ventilator the cover was formed in an "L" shape from ⅛-in. thick sheet metal. This fits over the top surface and upper half of the vertical surface of the ventilator, covering only that portion that is within the switchgear housing.

A mat of glass wool about ⅛-in. thick is used as a gasket to seal the perforations when the cover is fastened in place with wing nuts. When circulation is desired, the cover is inverted and held on the top of the ventilator with the wing nuts.

To close the upper ventilator a channel formed from ⅛-in. sheet metal was bolted into the overhang below the vent. The channel has six 1¼-in. holes, two threaded studs projecting from it, and a glass wool mat with matching holes cemented to it.

A smaller channel also having matching holes but with slots rather than bolt holes is fastened to the upper channel. The smaller channel can be moved longitudinally to align the holes in the members, and provide ventilation, or offset the holes, and close the vent.



Copper does its work without your watching it, without your checking it.

No matter where you put it . . . hidden away behind walls or deep in complicated mechanisms . . . copper will deliver the same trustworthy performance. It will not rust. It resists corrosion. Year after year, it serves . . . enduringly.

Even when it is out of sight . . . behind a coat of paint or underneath a plating of chrome . . . as long as you know it's copper, you can always be sure of getting copper's uniformly unexcelled service. And so can your customer!

For countless ages past, for artist and artisan alike, copper has been the metal of masterpieces. You can expect as much of copper in the future.

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WELDS READILY, EXCELLENT FOR SOLDERING AND BRAZING

The instrument that put electronics to work

Before electronics came into the picture, industrial instrumentation was caught in a squeeze. On one hand, it was besieged with demands by production men and engineers for higher sensitivity, faster speeds, and greater reliability. And on the other hand, it was hampered by the limitations of mechanical devices. For the instruments of fourteen years ago were merely mechanical imitations of a man watching a galvanometer needle and twiddling dials. They were too delicate . . . too sensitive to vibration . . . too easily led astray by wear or maladjustment. They just couldn't deliver the performance that new production methods required.

In 1940, however, came a major milestone in the progress of instrumentation—development of the *ElectroniK* potentiometer. This was not only a new kind of instrument. It was a new concept of measurement. For the first time, it applied the science of electronics in a practical way to the design of a measuring device for industry. It replaced complicated, fragile mechanical gadgets with a simple but sensitive electronic circuit and servo system . . . the "Continuous Balance" principle of measurement.

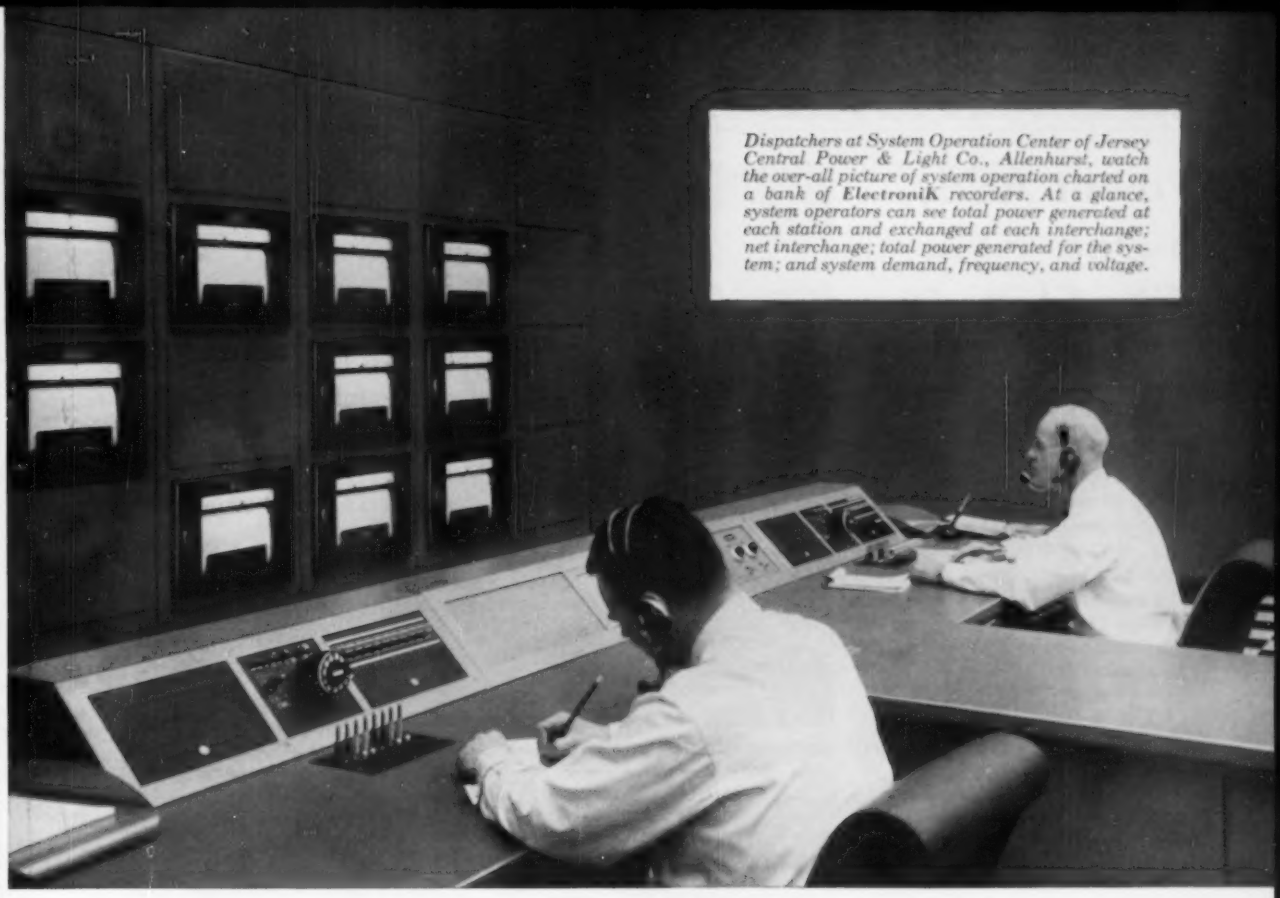
You could tell it was something new when you opened up the *ElectroniK* instrument's case. There was no sign of whirring gears, levers and cams. You could tell it was giving a new kind of performance in measurement, too, by the way the pointer would move swiftly and surely in one smooth sweep whenever the measured variable changed.

The *ElectroniK* instrument gained quick acceptance by production men, engineers, research technicians and maintenance men. They liked the way it provided laboratory accuracy and sensitivity, week after week, under the toughest industrial service conditions. They found that its speed and precision made possible improvements in product quality and process operation that had been unattainable before. And they have proved their confidence by ordering and reordering *ElectroniK* instruments by the thousands . . . not solely because it was *first* of its kind, but because it has continued to be the *best* in performance.

ElectroniK

recorders present system data for

CATALOG 1521 *describes and illustrates the complete Honeywell line of* **ElectroniK** *recorders and indicators. Send for a copy for your file.*



Dispatchers at System Operation Center of Jersey Central Power & Light Co., Allenhurst, watch the over-all picture of system operation charted on a bank of ElectroniK recorders. At a glance, system operators can see total power generated at each station and exchanged at each interchange; net interchange; total power generated for the system; and system demand, frequency, and voltage.

Jersey Central Power & Light

HERE in this centralized control room, the System Operation Center for Jersey Central Power & Light Co., system operators must make minute-to-minute decisions that carefully balance power generation and interchange against changing demand. And their decisions have to be right to keep over-all operation at peak efficiency and economy.

Reliable, accurate data on load trends is instantly relayed from all points in the system to three banks of *ElectroniK* recorders. High-speed telemetering equipment transmits remote load facts to the recorders in split-second time.

By glancing at one group of *ElectroniK* recorders on the instrument panel, dispatchers quickly see total power generated at each of the system's major generating stations and exchanged at each interchange. These duplex 2-pen instruments simultaneously record both megawatts and megavars on the same chart. Other *ElectroniK* recorders show total system generation, net interchange, system load, system frequency, and voltage at the Raritan River generating station's 115-kv bus.

Versatile *ElectroniK* instruments handle a wide variety of indicating, recording, and control jobs throughout industry. In the power field, too—from generation through distribution—their speed, accuracy, and high dependability pay off in improved system operation. Your local Honeywell sales engineer will be glad to discuss flexible *ElectroniK* instrumentation to fit your specific system requirements. Give him a call . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● REFERENCE DATA: Write for Data Sheets 9.1-3a, "Wide Chart Power Recorder"; 9.1-6a, "*ElectroniK* Frequency Recorder"; and 10.0-6a, "*ElectroniK* Duplex 2-Pen Recorder."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Power Adds 5-Deg. Heat; Kills Chills

M. L. BRUCE, Power Sales Engineer, Consumers Power Company, Jackson, Mich.

Adding five degrees of electric heat to "basic heat" provided by the old gas heating system has solved the problem of cold seepage through large glass panes at the modernized branch office of City Bank and Trust Co, Jackson, Mich.

Operational costs were termed "excellent." The installation proved to be a simple solution to the problem, and obviated installation of a larger furnace unit.

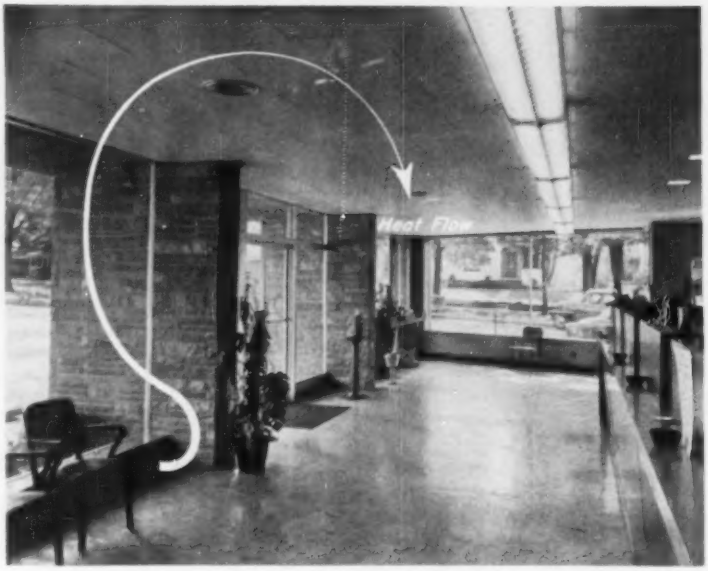
About five more degrees of heat were needed in the winter beyond that which the gas system could provide to maintain employee comfort. Furthermore, an air conditioner was needed during summer.

5-Ton Unit Chosen

So a 5-ton electric unit was installed to circulate air over the large window area. Its plenum chamber contains a 25-kw, 3-phase, 480-v finstrip heater for use on cold days. Its base houses a 110-v condensate pump which discharges into the rain downspout. (This arrangement is especially useful when a gravity system is impractical.) A small 480/110-v transformer serves the pump motor.

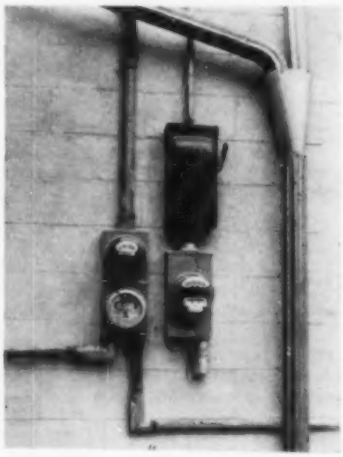
The heater is controlled by a locking type thermostat that employees cannot set. General temperature is controlled by a thermostat for the gas unit. A differential can be set with these thermostats so that the electric unit supplies heat only when the gas system becomes inadequate.

Power switch and meters were put outside because of a space shortage inside. Switch is rated 60-amp, 600-v ac, and is weathertight. The weatherproof meter socket is protected from lightning. Single-phase 120/240-v service is at the left (see photo) and uses a combined thermal demand meter and kwhr meter. The other instrument meters power to a barber shop, its conduit passing under the downspout.

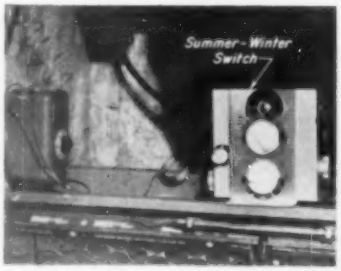


PLEASANT INTERIOR of bank is maintained in winter by supplemental electric heat. The ceiling has a poured insulation, but glass panes are ordinary plate

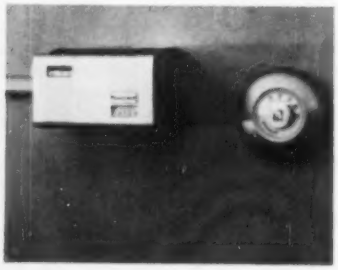
AIR CONDITIONING UNIT houses heater in top and condensate pump in bottom



OUTDOOR meters and switches helped solve an indoor space shortage problem



LEFT SWITCH protects finstrip from overheating when blower is not running



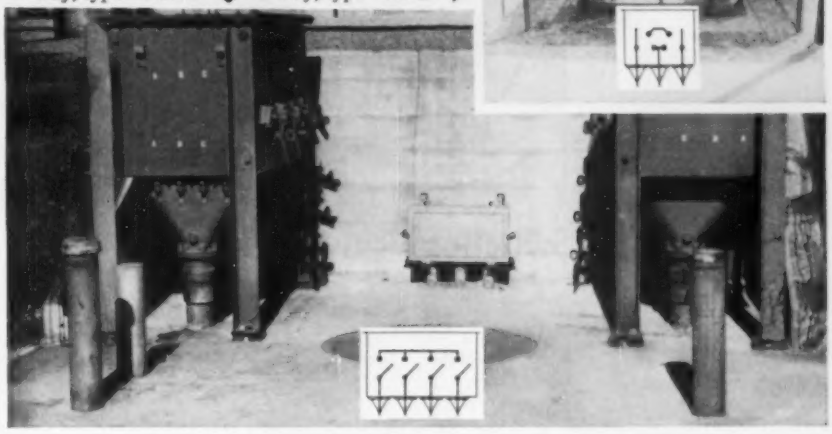
TWO THERMOSTATS, electric (left) and gas (right), control extra winter heat

Avoid Costly Shutdowns In Large Industrial Plants

by Providing

CABLE SYSTEM FLEXIBILITY

4 way, type "RAM" ▼ 3 way, type "RAL" ▶



G&W 15,000 volt, 400 ampere full load break oil switches provide safe sectionalization of cable system in a large oil refinery.

Adequate flexibility has become very important in recent years as the use of underground cable systems has increased. While outages on cable systems are infrequent, the length of time on such outages may be long enough to cause considerable inconvenience.

With "RA" switches located at strategic points in cable circuits to provide flexibility, a system can be so arranged that important loads will have an alternate source of power immediately available.

Since their introduction in 1928, Type "RA" switches have had a trouble-free operating record which fully justifies their use as load break disconnects for single or multiple circuits. They are safe and reliable, combining simplicity with economy in construction, installation, and maintenance. They will operate properly after long periods of inactivity to provide fast and convenient isolation of cable sections in case of trouble and to permit rapid rerouting of circuits to materially reduce losses normally incurred through electric service interruptions. Exposure to weather extremes or complete submersion for prolonged periods will not affect prompt and safe operation when necessary. They are water-, oil-, and air-tight.

Write us for Series "DB" bulletins or get in touch with our nearest representative for further information. We will be glad to help you apply Type "RA" oil switches to your distribution system.

G & W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois, U.S.A.

Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

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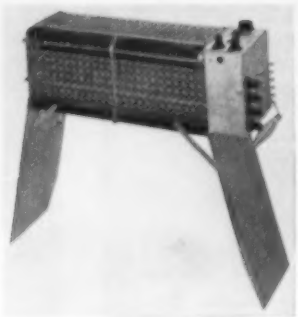
RESISTANCE TYPE RELAY LOADS...

Accurate·Quick·Safe

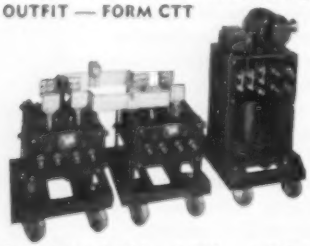


Ohm-spun LOAD—TYPE WRL

Made in 3 loads. Capacities:
(1) 30 Amp. 120 V.
(2) 60 Amp. 120 V.
(3) Double voltage load: 50 amp. 120 V. and 25 Amp. 240 V.

Smooth adjustment from .05 ampere to the full capacity of the load.

CURRENT TRANSFORMER LOADING OUTFIT — FORM CTT



Capacities: 1,000 - 2,500 - 4,000 - 6,000 - 10,000 - 12,000 amperes.

Portable or stationary types. Smooth adjustment from near zero to full capacity of the load.

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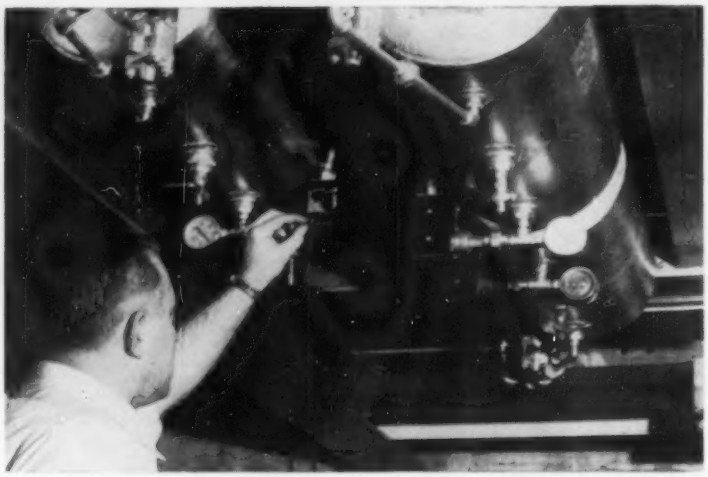


Switches Prevent Compressor Overload

A. L. CARROLL, Manager, Technical Services, Con Edison, Mt. Vernon, N. Y.

Automatic programming of four air compressors through an electro-pneumatic control arrangement guards the leading machine from overload when air demands are unusually high at University Loudspeakers, Inc, White Plains, N. Y.

A reverse-action pressure switch is attached to a small air tank that is empty when the No. 1 compressor comes on for a pumping cycle. Air coming from the unloading line of the compressor goes through a pressure-regulating valve and a needle valve. The time for this tank to accumulate 40 lb pressure is set for a minute. (This time can be set for a different value if desired.) If the compressor pumps for more than a minute, indicating that the air demand has increased, the No. 2 compressor starts pumping automatically. This repeats until the pressure is built up, or until all four compressors are pumping.

Each machine has a similar "pilot-pressure" tank and pressure-operated electric switches. If desired, the main switches can be set so that any compressor can become the "leading" machine. Under one arrangement, for instance, No. 3 machine might come on first when air pressure drops. It would be followed by machines Nos. 4, 1, and 2. This control scheme also permits one or more compressors to be shut down for repairs or overhaul without affecting the supply of air in the plant network.

This control system was designed jointly by Harry Weissman, plant engineer for University Loudspeakers, Inc, and Philip Diamond of Monogram Electric Products Co, New York City.

Electricity Molds Dishes with Superior Results

P. C. LaMARRE, The Detroit Edison Co, Detroit, Mich.

Molding granular polyethylene plastic into mixing bowls, cups, juice containers and other household products is accomplished with superior results at The Plastray Corp, Detroit.

Strip heaters, shaped to the outside of the cylinder through which the plastic is fed, heat the material to 400F or 650F. Cartridge heaters hold the dies at this temperature while the products are formed. Heat requirements of the individual machines range from 6 kw to 20 kw.

Electrically heated water helps hold the mold at the proper temperature. This water which circulates through the dies, is heated by 18 kw of immersion heaters. A "shot" of fresh water will chill the dies when necessary.

There's always a CHANCE for a better connection

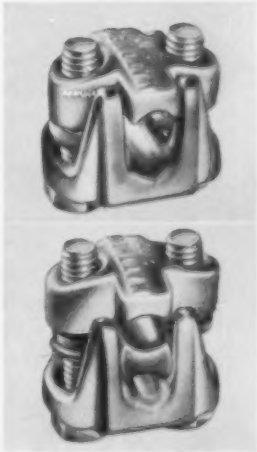
When you're looking for a good connection — don't overlook CHANCE. Because — whatever type connector you want, chances are Chance has it. Everything from parallel groove clamps to solderless terminal lugs. The Chance line represents a wide variety of connectors — all available from a single source — your Chance Distributor.

Uni-clamps go on fast— clamp tight—cost less than split-bolts of the same size

A "one-piece" clamp for conductors 1/0 through 1000 MCM. Uni-clamps are easily installed without taking them apart . . . offer a wide contact area plus extra strength for permanently tight contact. Smooth-rounded castings can be readily covered with protective tape. Available for copper, aluminum, or bi-metal connections.

z.l.n. 100 Electrical contact sealing paste

Protects any bi-metal combination against corrosion and improves conductivity. Waterproof, stays plastic. Works in all temperatures. Non-toxic. Non-inflammable.



Parallel Groove Clamps*

Heavy-duty Parallel Groove Clamps

Uni-Clamps

Split-bolts

Multi-tap

Service entrance connectors

Transformer tank grounding terminals

*Chance Parallel Groove clamps are made in two types: Type "AA" for aluminum to aluminum connections; Type "AGP", fortified cadmium coated, for all conductor combinations. AGP clamps don't require an insert . . . can't be put on wrong. Either side will take copper or aluminum.

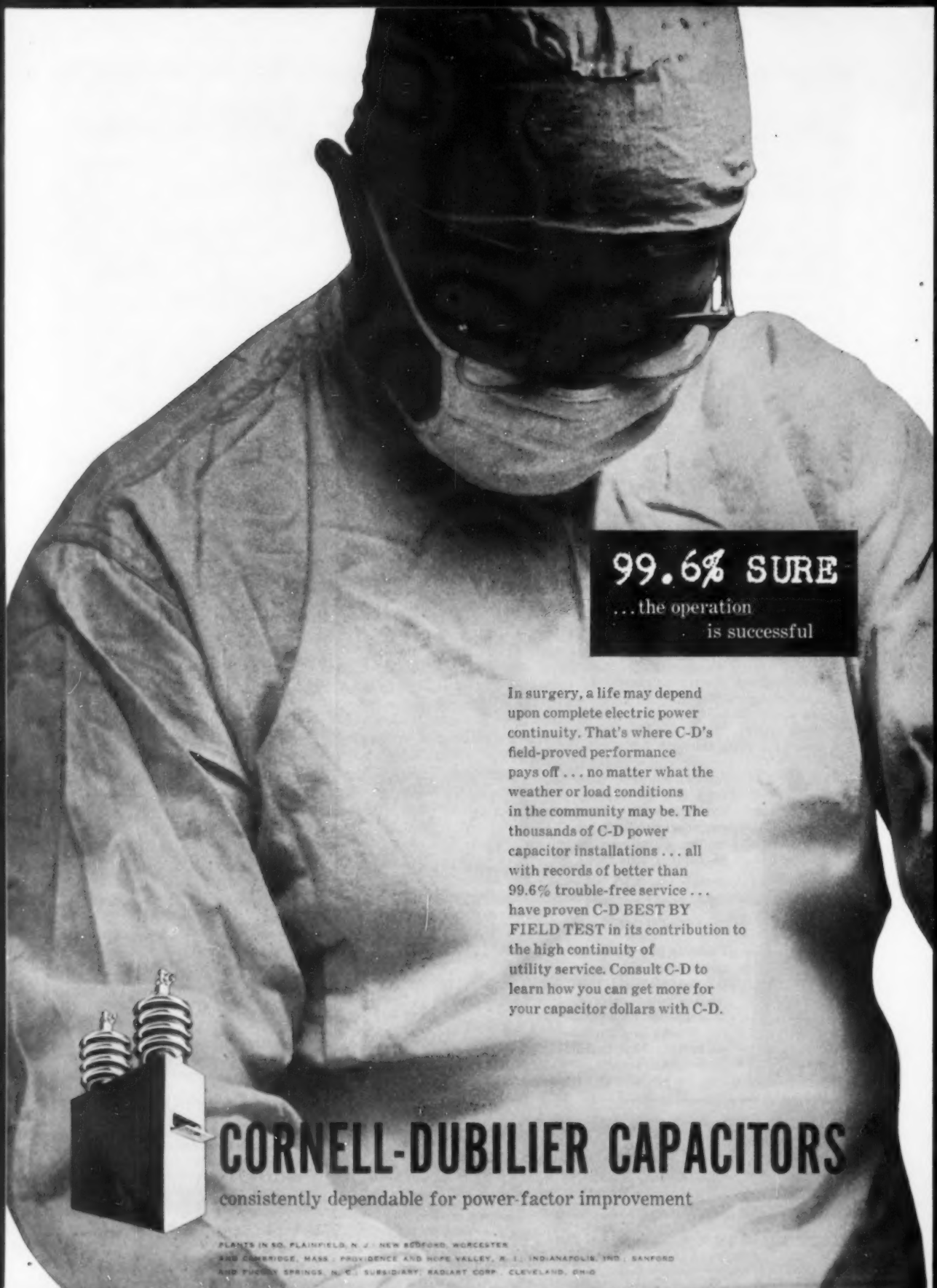
ABC INDUSTRIES

CC55-10

A·B·CHANCE CO·

CENTRALIA, MISSOURI • San Francisco, California

(In Canada: A. B. Chance Company of Canada, Ltd., Toronto 13)


99.6% SURE
...the operation
is successful
In surgery, a life may depend upon complete electric power continuity. That's where C-D's field-proved performance pays off . . . no matter what the weather or load conditions in the community may be. The thousands of C-D power capacitor installations . . . all with records of better than 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.
CORNELL-DUBILIER CAPACITORS
consistently dependable for power-factor improvement
PLANTS IN SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER
power-factor capacitors give you better than 99.6% trouble-free service*

Low dielectric unit stress provides an extra margin of safety that results in the ability to withstand higher transient voltages. When you buy C-D, you buy premium quality at no extra cost.

C-D capacitors are impregnated and filled, in hermetically sealed containers with non-inflammable, non-explosive Dykanol. In addition, C-D's conservative engineering and design makes possible the use of special impregnants to fulfill even the most exacting requirements for sub-zero switching operations.

Extra strength wet process two piece porcelain terminals . . . one of the many important reasons why C-D capacitors can point to year after year of trouble-free service in coastal areas.

Another evidence of C-D's premium quality power capacitor service . . . at no extra cost . . . is the fact that C-D has *no* "Return Material Department". Most repairs are of such a minor nature that they are handled on an individual basis. This results in a prompt, personalized service impossible where the safety factor has been cut in favor of production, weight and size economies.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

This pole-mounted C-D Capacitor installation has been on the job for an Eastern utility since 1939 with little or no maintenance.

*This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.

INDUSTRIAL BRIEFS

Bonding glued wood joints is accomplished more effectively by Quality Woodcraft Co, St. Louis, with an electronic wood welder. This method saves time and provides a better bond in the fabrication of cabinets. An estimated 50% is saved in the set-up time formerly required to clamp work after gluing. This method virtually eliminates the use of screws, nails, and clamps. Glue sets in seconds. The electronic welding unit is semi-portable. It operates at 115 v, single phase, 25 amp, 60 cps. The output is at 27.15 mc. A. L. Chiodini, Industrial Sales Engineer, Union Electric Company of Missouri, St. Louis, Mo.

Heating bus engines electrically has enabled the Woodlawn and Southern Motor Coach Co serving Aliquippa, Pa., to "garage" its buses outdoors during bitter winter weather. Inserted into the engine cooling system and plugged into an inexpensive electric supply line outdoors, these 2.5-kw heaters have obviated new garages to house the fleet of buses. They also proved that excessive engine wear and battery deterioration caused by cold weather could be minimized, if not eliminated. A radiator in the passenger compartment keeps the bus interior comfortable for the early morning passengers. The company reports that buses parked outdoors in cold weather do not depreciate faster than those parked in the garage. J. D. Aldridge, Industrial Salesman, Duquesne Light Co., Pittsburgh, Pa.

Formica covering is glued to wood table and cabinet tops at Wallis Cabinet Co, North Kansas City, Mo., by subjecting the parts to pressure between two plates of a press held at 190F by 7,000 w of thermostatically controlled electric heat. Only 3 min are required for bonding and curing a 50 x 33-in. section, and power costs average between $0.75 to $1.00 a day. The previous bonding method required 2 to 5 hr, and 6 hr more for air curing (done overnight). But uneven clamping pressure sometimes caused faulty bonds, which had to be repaired. The new method has cut labor appreciably. G. H. Molesworth, Industrial Engineer, Kansas City Power & Light Co., Kansas City, Mo.

Mass Home Builder Growing in Importance

Built-in appliances market is spur to sales of manufacturers and residential load of utilities, General Electric Utilities Sales Conference is advised

As the retail consumer is now, the merchant home builder is fast becoming—at least as far as electrical appliances are concerned.

The growing importance of home builders to utilities and the sale of built-in units with color was strongly emphasized at General Electric Co's annual Utility Sales Executives Conference last month.

Meeting at Appliance Park, Louisville, Ky., some 200 power sales chiefs heard reports of present marketing trends and had a look at some developments for the future. These were the topics:

About the Home Builder . . .

"He's not interested in fuels, only in what sells his houses," declared H. L. Moore, Southern California Edison Co, "and we sell him on this premise." Moore, whose company serves an area where 90% of all homes are erected by merchant tract builders, said, "They're finding electric homes sell fastest. For example, one builder, after failing to make expected sales with gas built-ins, took them out, put in electric, jacked the price $2,200, and sold 11 homes in the first weekend. This is typical of what can happen."

He outlined his company's program for selling builders:

1. A permanent builder department with staffmen in continual contact with the building trades.

2. Kitchen layout planning service.

3. Promotional and advertising helps to the builder.

4. Personnel help on a tract's opening day.

5. Regular meetings with builders and their salesmen.

To help utilities develop builder sales programs, GE is offering them the service of an all-electric caravan (See box). The caravan stems from the highly successful presentation last summer in communities served by the American Gas & Electric Co (EW, Oct. 17, p115).

About Water Heaters . . .

Twenty-two percent of the country's utilities now permit sale of high-wattage, quick recovery water heaters, declared R. B. Day. But he noted that the ratio of gas to electric water heater sales is still against us (3 to 1) and continues to rise. Day asked power suppliers to give full study to the quick recovery unit. And since 50% of all water heaters are sold by plumber-dealers (91% of those going into new homes), he urged them to work closer with the plumbing and building trades.

About Ranges . . .

Built-ins are fast becoming the king pins of range sales (25% of GE's expected '56 volume), declared H. A. Oliphant. They represent the best potential for knocking gas out of the picture. The ratio of built-in sales is currently 22.8 to 1 in favor of electricity.

GE expects to have a new electronic oven ready for the home market a year from now which can cut cooking time up to one half that required by conventional methods. It works on regular range wiring, and power factor, now at about 80%, is expected to be improved.

About Air Conditioners . . .

The 1956 air conditioner will have a pf of 90% or better, said Paul Augenstein. He also promised a year-round reverse-cycle unit in the next two years. This would jump load factor from today's 22% to better than 70%.

Augenstein foresaw a billion dollar business by 1964. Manufacturers' sales then will be running at 3.7 million room air conditioners per year com-

(*Continued on page* 146)

Building Industry Show Offered Utilities

To help utilities boost their sales programs among merchant builders and allied construction trades, General Electric Co. has announced a traveling all-electric caravan to be ready for showing next February.

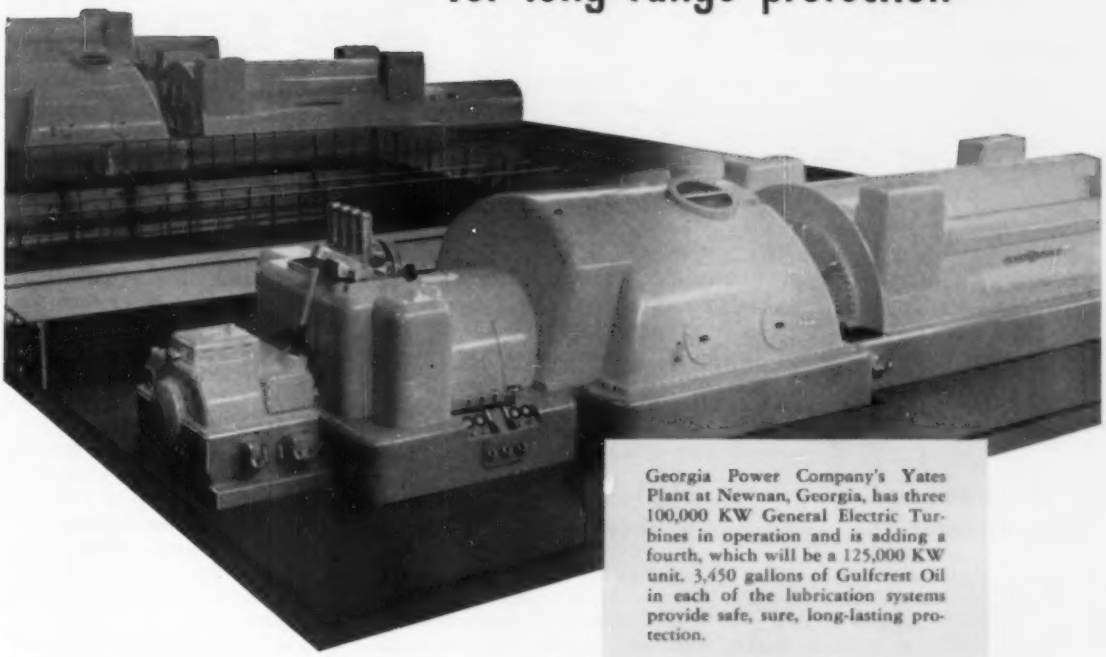
Themed "Modern Electric Homes Sell Faster," the caravan consists of a self-contained, portable stage exhibit equipped with all the elements of the true all-electric home. It simulates a combined living room and kitchen completely decorated and furnished with color-styled built-in kitchen, modern lighting, adequate wiring assemblies, remote control wiring, built-in heat pump, air conditioning and resistance heating. Exhibit measures 37 x 20 x 13 ft.

GE will furnish the presentation itself including the exhibit, speakers, and transportation plus literature, distributor cooperation, and an architectural consultant to handle follow-up work for a couple days after the show.

For its part the utility would issue the invitations and furnish the hall, the refreshments, and an employee to work as the show's contact man and coordinator.

Georgia Power Company looks ahead—

selects GULFCREST OIL for long range protection



Georgia Power Company's Yates Plant at Newnan, Georgia, has three 100,000 KW General Electric Turbines in operation and is adding a fourth, which will be a 125,000 KW unit. 3,450 gallons of Gulfcrest Oil in each of the lubrication systems provide safe, sure, long-lasting protection.

Gulfcrest Oil has been in service at the Yates Plant of Georgia Power since 1950. Turbine systems are clean, there is no rust, sludge, or foam. But this is only the beginning. Gulfcrest will provide safe, sure protection for many years to come. (Gulfcrest has been in continuous service in several large turbines for over 20 years.)

There are good reasons for Gulfcrest's recognition as the world's finest turbine oil. Carefully selected crude oils are thoroughly refined, then super-refined by Gulf's exclusive Alchlor Process. This removes the unstable hydrocarbons that accelerate oxidation, form sludge and harmful acids. Then the right additives are properly combined, and you have a turbine oil that delivers superior performance in every type of steam turbo-generator.

A trained, experienced lubrication expert—the Gulf Sales Engineer—is as near as your telephone. Have him recommend the right grade of Gulfcrest for your turbines. Consult the telephone directory for the number of your local Gulf office.

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

GULF OIL CORPORATION • GULF REFINING COMPANY

1822 GULF BUILDING, PITTSBURGH 30, PA.

Builders Gain Importance

(*Continued from page* 144)

pared with 1 million now. He said room conditioner sales in 1962 alone will put 7 billion kwhr added usage onto power lines. He suggested that utilities supply a new service entrance switch without charge when a customer buys a 230-v room air conditioner. This, he said, would pave the way for the range, water heater, and other heavy-use devices.

About Refrigerators . . .

Selling refrigerator-freezer units to half of every 100,000 customers on your lines could mean $42,000 per year in extra utility revenues, K. G. Roe said. Turning to GE's 1956 refrigerator line, he showed them a new safety feature: Silent closing, latchless magnetic doors, available at no extra cost, which permit opening from the inside as well as from the exterior. The outside is foot pedal operated.

About Clothes Dryers . . .

Future of the dryer business, hottest item in the industry this year, lies in the combination washer-dryer unit, said GE spokesmen. Some 10 million such units plus 10 million regular dryers will be in use in 1965.

About Future Appliances . . .

Vice Pres C. K. Rieger rolled out some new GE products due on the market within the next two years. Among them:

- A built-in kitchen appliance center lowered to counter height (54 in.).
- A refrigerator with a high-humidity, third temperature zone (32½ to 34F) capable of keeping fresh fruits and vegetables up to six months.
- Built-in frozen food "files."
- A dishwasher plus a unit for handling greasy pots and pans with no pre-rinsing required.

Media Help Round Up Dealers

Newspapers and radio stations sell tie-in ads to dealers to earn Arkansas P&L advertising in smash freezer campaign

Local advertising media can do more than just carry a utility's ad messages. Arkansas Power & Light Co has put newspapers and radio stations in its service area to work in another way: Building dealer participation in sales campaigns.

During a three-month freezer promotion last summer, AP&L offered newspapers and stations extra advertising on the basis of tie-in space and time they, themselves, sold to electrical dealers. The result: AP&L got extra ad penetration and dealer cooperation, the media picked up extra ad sales. And the dealers? They sold a record breaking 3,714 food freezers, 156% of the quota set at the beginning of the campaign.

75 Newspapers Take Part

Every newspaper in the area was offered a chance to earn a seven-column AP&L ad during a week in the middle of the campaign. Up to 50 in. of tie-in space sold to dealers netted the newspaper a three-column ad, 50 to 100 in. a five-column ad, and over 100 in. a seven-column ad.

Seventy-five newspapers entered the promotion. Together they sold a total of more than 10,000 column in. of tie-in advertising and AP&L followed through by placing 9,000 column in. of its own space. This was in addition to 6,665 column in. the company already had scheduled for food freezers. At least 57 of the 75 participating newspapers sold more than 100 column in. to qualify for the big 7-column ad.

3,720 Radio Spots

Radio stations were offered two quickie announcements, 15-sec a day for a 30-day period if they sold a minimum of two 30 or 60-sec daily spots to dealers. This was timed for the middle of the campaign and 31 stations ran 3,720 freezer spots during the period.

Other advertising and promotional helps:

- Twenty-three 24-sheet posters exposed for a month at key points. They carried the theme, "Live Better with a Home Freezer."
- Distributors set up month-long window and floor displays in the company's business offices.
- Dealer salesmen were given a "spiff," $6 in cash, for each freezer sold. The "spiff" was paid by the company and the distributor.
- AP&L sales personnel put on 655 freezer demonstrations before a total audience of 9,518.

The company reports 293 dealers took part in the promotion. Distributors responded 100%.

Better Servicing a Must, Quinton Tells PCEA

Customer dissatisfaction with electrical appliances after they have been installed is breeding a public relations problem for the electrical industry. A challenge to solve this problem was handed down by Harold Quinton, president, Southern California Edison Co, before the business development section of the Pacific Coast Electrical Association, Pasadena, Nov. 3-4.

The 277 registrants at the meeting also appraised the present situation and planned a program of goals for the coming year as they discussed agricultural electrification; residential wiring and lighting; and commercial-industrial wiring, lighting and power utilization.

Dissatisfaction with appliances, said Quinton, is the result of inadequate servicing and the lack of follow-up to show the customer how to use the equipment properly. When the utilities ceased to merchandise, he said, dealers and distributors asked that servicing be turned over to dealers. Quinton cited newspaper protests that prove this responsibility has not been met.

Wiring figured in practically all sessions. The subject was keynoted by C. C. Walker, chairman, National Adequate Wiring Bureau, and commercial vice-president, General Electric Co, San Francisco. In an opening address to the section, he outlined the methods for promoting adequate wiring.

Greatly increased acceptance of 100-amp minimum service entrance by tract home builders was indicated in the residential adequate wiring committee meeting under John R. McNeese, California Electric Power Co.

(*Continued on page* 188)

Simplex Cables power and control longest, single-span vertical-lift bridge in the world!

Cape side of canal with bridge span down. Seven of nine cables visible are Simplex-ANHYDREX. Light-colored square beneath catwalk is 1100-ton concrete counterweight that rides inside the framework of each tower.

U. S. Army's 544-foot railroad span over Cape Cod Canal raised 130 feet with ANHYDREX

The 2200-ton span, located near Buzzards Bay in Massachusetts, carries the only railroad track between Cape Cod and the mainland.

Army and Air Force installations on the Cape depend upon this track for supplies. Therefore, both normal and emergency electrical circuits on the bridge must be as near perfect as possible.

The railroad company that maintains the bridge specified Anhydrex-insulated cables with neoprene jackets. Army engineers, who own and operate the bridge, approved this choice.

ANHYDREX Cables withstand effects of moisture, corrosion from salt air, sunlight and swaying in high winds.

Want the same service from power and control cables as the Army engineers? Ask your nearest Simplex representative about ANHYDREX Cables, or write to the address below.

Closeup of ANHYDREX Cables. Mainland on left. Span is raised and lowered by two 150-horsepower electric motors that turn 16-foot sheave wheels atop the bridge's two towers.

Simplex-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Massachusetts

NEW EQUIPMENT

Aerial Ladder

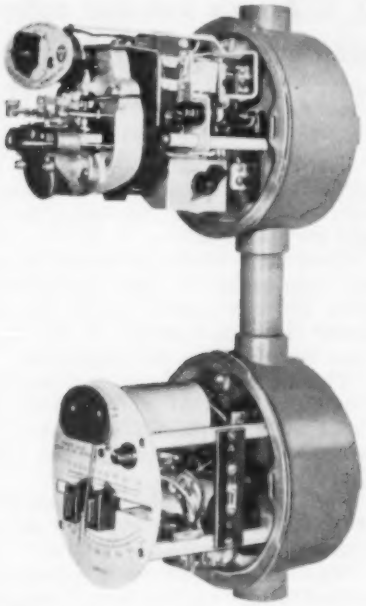
This ladder rotates 360 deg and elevates to 72 deg. It is available in 24, 28 and 32-ft ground-to-platform heights and with duo-level or standard platforms.

The manufacturer reports that elevating locations are infinite and the elevation angle can be changed with ladder fully extended. The ladder can be lowered when fully extended with a man on the platform.

The aluminum duo-level platform features two working positions: At higher angles the workman stands on the part of the floor in the conventional position; at lower angles he steps down onto the part that extends at an angle. A levelling bar adjusts the floor for either position.

The Series 2500 ladder is operated by a low-pressure hydraulic system and center-mast counterbalancing. Rotation can be worm and gear or pin type and telescoping bar.

J. H. Holan Corp, 4100 West 150th St, Cleveland, Ohio.



Current-Modified Voltage Control

This current-modified voltage control is designed to actuate oil switches for capacitor banks. The voltage control directly initiates switching action. The current control changes the operating level of the voltage control by removing or inserting a bias voltage.

The voltage control has a 1½ to 12-v adjustable band width, 110 to 130-v operating range, and time delay of about 60 sec. Other features include a rheostat to adjust bias voltage, 20-amp load contacts, fuses for both load and control circuits, and a lightning arrester.

The current control has a ¼-amp minimum band width over a 5-amp scale, a thermal element for time delay, and a fuse for the control circuit.

Each unit is mounted in a standard 6-prong meter base. The voltage control has a weatherproof aluminum cover, while the current control has a glass cover.

Line Material Co, Milwaukee 1, Wis.

Electric Duct Mouse

This electric duct mouse is said to thread iron, concrete, transite or fibre duct at more than 2 fps. It operates through sand, dirt and water, detects offsets, fractures, cave-ins and blocks, and can be withdrawn by a reinforced power cable of 1,000-lb pull strength, the manufacturer says.

The 9½-lb unit has a completely enclosed 110-125-v, 60-cps, single-phase ac-dc motor. Rotation of eccentric weights on the motor shaft develops 10,000 vibrations per min which are transmitted to sets of tractor brushes mounted on the motor housing.

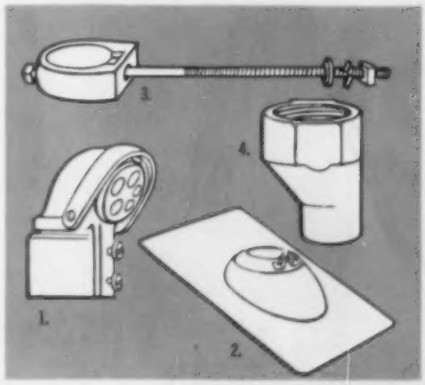
A CP-31-4RD duct-rodding kit consists of 2 motors, 4 spare brushes, brush wear gauge, metal carrying case and an 18-in. reel with 600 ft of heavy-duty moulded cord containing 2 copper conductors and 2 stranded steel cables.

Chicago Pneumatic Tool Co, 6 East 44th St, New York 17, N. Y.

Hubbard Service Entrance Mast Kit

The new Hubbard Service Entrance Mast is your answer to the low roof service problem. Because it is designed to conform to the latest service entrance practices, local requirements can be met with a minimum of time and expense. Easily assembled with only a few electrician's tools, the installation is fast, weather-tight and permanent.

Two complete kits are available for use with 2-inch or 2½-inch conduit risers. Each kit contains Slip-fitter Entrance Head (1), Galvanized Roof Flashing (2), two Mounting Brackets (3), and Offset Reducer (4) for Meter fittings. All accessories necessary to meet local installation requirements are available and must be specified separately. For complete information write for copy of Bulletin P-1255.



HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.

Aerial Tower

This hydraulic, operator-controlled aerial tower is designed for mounting on conventional motor trucks, industrial trucks or flat cars.

It is available in 30, 45 and 60-ft models with wheeled outriggers or spring lock-out table. All models feature one-hand control from platform, independent power source, 280-deg rotation, and almost full use of bed of vehicle carrying the tower. The turn table is levelled front to back or side to side on any terrain.

At the end of the welded steel boom is a self-levelling 2-ft by 4-ft platform. The double-jointed boom on 30 and 45-ft models is solid plate and on the 60-ft unit is open fabricated steel.

Elkhart Welding & Boiler Works, Inc, 2132 S. Main St, Elkhart, Ind.

Automatic Office Machines

This automatic adding machine is designed to transmit by perforated tape such information as meter readings and account number from a utility's branch office to the main office for billing. It also can be used to send financial data, payroll information, sales statistics, and other data.

An automatic accounting machine (not illustrated) can be used to post a complete payroll on a perforated tape for transmission to the home office. The manufacturer states that the machine can be used to post stores accounting, payables, distribution, and similar information.

Both units operate at a rate of 30 digits per sec.

Monroe Calculating Machine Co, Orange, N. J.

Adjustable Tripod

This 66-lb adjustable height tripod is said to handle three tons when set on ramps, platforms or rough ground without digging in the uphill leg.

The model shown extends to a working height of 10¼ ft and closes to 6½ ft. Telescopic legs adjust in 6-in. steps.

The tripod is made of steel and aluminum alloys. It is available with screw-in spikes or non-skid pads for attachment to the base.

B. E. Wallace Products Co, Exton 20, Pa.

(More New Equipment on page 153)

Correction, Please!

A constant wattage lamp ballast was listed for Line Material Co, Milwaukee, in Electrical World, Nov. 14, page 200. The new ballast has a high secondary open-circuit characteristic that allows lamp starting even at temperatures well below zero degree F.

This statement on the characteristic is given to correct a possible misunderstanding when reading the first sentence of the second paragraph of the article. "High secondary open-circuit characteristics allow lamp starting at 0 F."

THIS COMPLETE LINE MEETS EVERY NEED FOR PUSHBUTTONS

DESIGN LEADERSHIP

STANDARD DUTY

HEAVY DUTY

Name your pushbutton requirement—there's a Square D unit to do the job, exactly. Three complete lines . . . standard duty, heavy duty, and oil-tight heavy duty . . . each providing a wide range of operators, stations, and circuit combinations.

OIL-TIGHT HEAVY DUTY

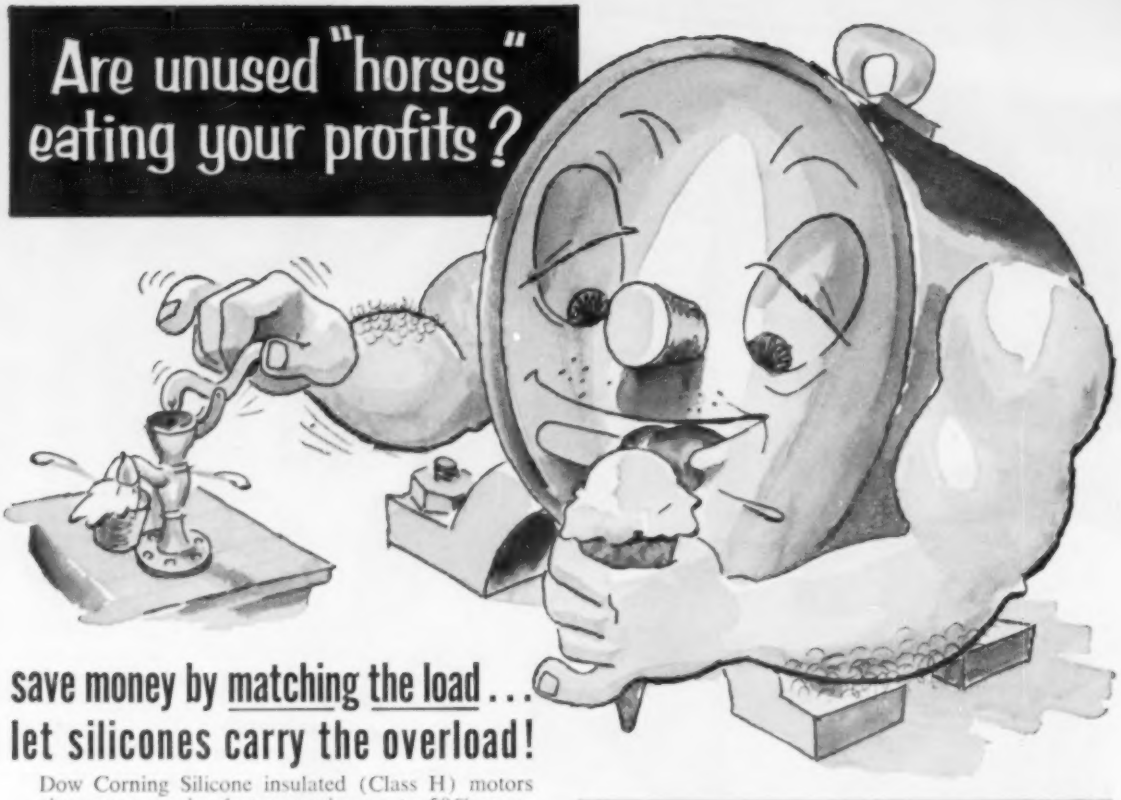
Available in 1 to 16 unit sizes. 6-9-12-16 unit stations have hinged covers for easier wiring

Write for Pushbutton Bulletins which give complete details. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

Are unused "horses" eating your profits?



save money by matching the load . . . let silicones carry the overload!

Dow Corning Silicone insulated (Class H) motors give you a service factor ranging up to 50% compared with 15% for Class A.

This extra service factor enables you to install Class H motors rated at normal load requirements and yet meet initial or intermittent overloads, or loads that can't be matched in standard frame sizes.

In one of our fluid pumping applications, for example, normal load is 5 hp; intermittent loads range up to 9.2 hp. Instead of following the old fashioned practice of overmotoring with a 10 hp Class A motor, we use a 5 hp Class H motor and let silicones carry the overloads.

That means less capital investment in motors. It also means a better power factor and higher efficiency because smaller silicone insulated motors operate nearer full load more of the time than larger motors rated to meet maximum overloads.

And you get more reliable operation because motors insulated with Dow Corning Silicones have superior resistance to heat, and moisture and to corrosive atmospheres.

Remember, overmotoring is outmoded

to help you avoid overmotoring

Sier-Bath Gear and Pump Company, Inc. of North Bergen, N. J., now offers silicone insulated (Class H) motors as optional equipment on all of their positive displacement pumps. These Class H motors with their built-in service factor permit you to match the average load and safely carry initial or intermittent overload. You get all of the advantages of more compact equipment and more efficient operation.

Dow Corning Corporation, Dept. 4412, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

☐ Information about Sier-Bath pumps with Class H motors

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____

DOW CORNING SILICONES

DOW CORNING CORPORATION

MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT
LOS ANGELES • NEW YORK • WASHINGTON, D. C. (Silver Spring, Md.)

CANADA: Dow Corning Silicones Ltd., Toronto
GREAT BRITAIN: Midland Silicones Ltd., London
FRANCE: St. Gobain, Paris

Polyethylene Pipe

This Bakelite polyethylene pipe (arrow), mounted under a pole crossarm, protects non-metallic sheathed cable and keeps secondary wires from interfering with standing room. It can be used also to protect ground wires, secondary wiring for network installations, or an overhead-to-underground service run.

Weather conditions are reported to have little effect on this pipe which can be cut with a saw and bent by hand. It is available in 0.5 to 6-in. sizes, in 100 or 300-ft coils, or custom lengths.

Insert fittings molded of Bakelite high impact styrene plastic can be secured in the end of the pipe with a screw clamp to form a coupling, T-joint or elbow, or to connect to metal pipe.

Triangle Conduit & Cable Co, Inc, Plastic Pipe Division, Triangle & Jersey Ave, New Brunswick, N. J.

Carbon Brushes

A series of electrical brush grades is said to combine the longest brush life with the highest commutating ability. The series is designed to service the complete range of industrial motor and generator applications.

Grade N-1 is a low contact drop brush. It is intended to replace metal-graphite brushes on some 32-v units.

Grades N-2 and N-6 are designed for operation at high temperature.

Grade N-4 is a general-purpose industrial brush recommended for heavy duty industrial machines.

Grade R-64 offers long life under severe service at very high speeds. **National Carbon Co, 30 E. 42nd St, New York, N. Y.**

(*More New Equipment on page* 154)

Quick, dependable carrier measurements—3 to 500 kc

New Model 104 Carrier Frequency Voltmeter—5 to 150 kc

Four Frequency-Selective Voltmeters

Four precision frequency-selective voltmeters for carrier system measurements are now offered by Sierra. Including the new Model 104, these instruments cover all frequencies 3 to 500 kc. They provide a fast, accurate means of measuring voltages in telephone, telegraph, telemetering and control circuits. They also make possible quick, dependable tracing of circuit faults. All four instruments have direct reading meters calibrated in dbm from −20 to +2 dbm on the meter and −60 to +40 dbm on the range changing attenuator. All contain a built-in calibration oscillator and a VTVM for swift, simple calibration. **For details, request Bulletin 107.** *(For wave analysis and harmonic studies 15 to 500 kc, Sierra offers Model 121 Wave Analyzer. Request Bulletin 103).*

SPECIFICATIONS

Model No.	Frequency Range—kc	Input Level Range—dbm	Selectivity		Direct Reading in dbm	
			Down 3 db	Down 45 db	Balanced	Unbalanced
101A	20—500	−80 to +42	± 750 cps	± 6000 cps	*	600 ohms
103A†	3—40	−80 to +42	± 400 cps	± 3000 cps	**	600 ohms
104	5—150	−80 to +42	± 300 cps	± 1500 cps	**	600 ohms
108A	15—500	−80 to +42	± 600 cps	± 3000 cps	135 ohms*	600 ohms

*May be converted for 135, 500 or 600 ohm balanced line measurements with Sierra 122 Line-Bridging Transformer. (Low cost, plug-in unit). **Same as 101A except uses Model 133 Transformer.
†Contains carrier re-insertion oscillator for monitoring single side band suppressed carrier systems.
Data subject to change without notice.

Sierra

Sierra Electronic Corporation
San Carlos 2, California, U. S. A.
Sales representatives in major cities
Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Wattmeters, Reflection Coefficient Meters.

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
Manufacturers of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

Mobile Hypot

This 70-kv mobile dc test unit is primarily designed for acceptance and proof testing of cables rated up to 15 kv, but is equally applicable to rotating machinery, switchgear, transformers, and similar equipment.

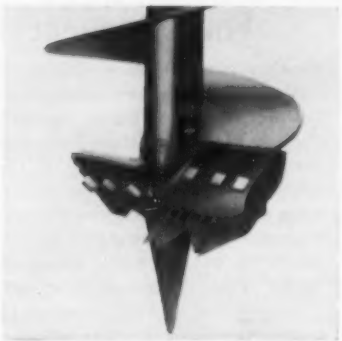
Metering includes: (1) A 4.5-in. voltmeter with 0-70-kv scale, accuracy within 3% of full scale; (2) a 4.5-in. ammeter with 0-2.5-ma scale, accuracy to 2%, automatically protected against overload.

A voltage quadrupler circuit is used with a dry-type transformer with selenium rectifiers, capacitors and meter-multiplier resistors immersed in oil for corona-free operation. Input is 115 v, ac, 50/60 cps.

Model 469 is housed in a steel case 29 x 23 x 18 in. mounted on rubber-tired wheels. It is furnished with 10 ft of high-voltage cable, and a plug and socket arrangement.

Other features include an on-off circuit breaker, suitable pilot lights, non-locking push-button switch to energize high voltage, and a zero-return interlock.

Associated Research, Inc, 3760 W. Belmont Ave, Chicago 18, Ill.



Earth Auger

A new line of augers for use with mechanical and hydraulic portable earth borers is available in anchor, short-flight and long-flight types. Holes 8-ft deep can be dug with augers of 8, 9, 10, 12, 14, 16 and 22-in. diam.

The augers can be furnished with either standard or Pengo head. The Pengo cutter heads feature a twin-helix pilot bit that provides two equal cutting areas.

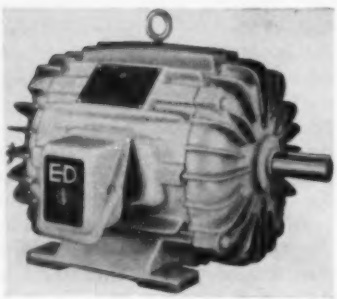
J. H. Holan Corp, 4100 W. 150th St, Cleveland 11, Ohio.

Totally Enclosed Motor

A rerated totally enclosed non-ventilated and totally enclosed fan-cooled motor is designed for operation where non-combustible dust and moisture are prevalent.

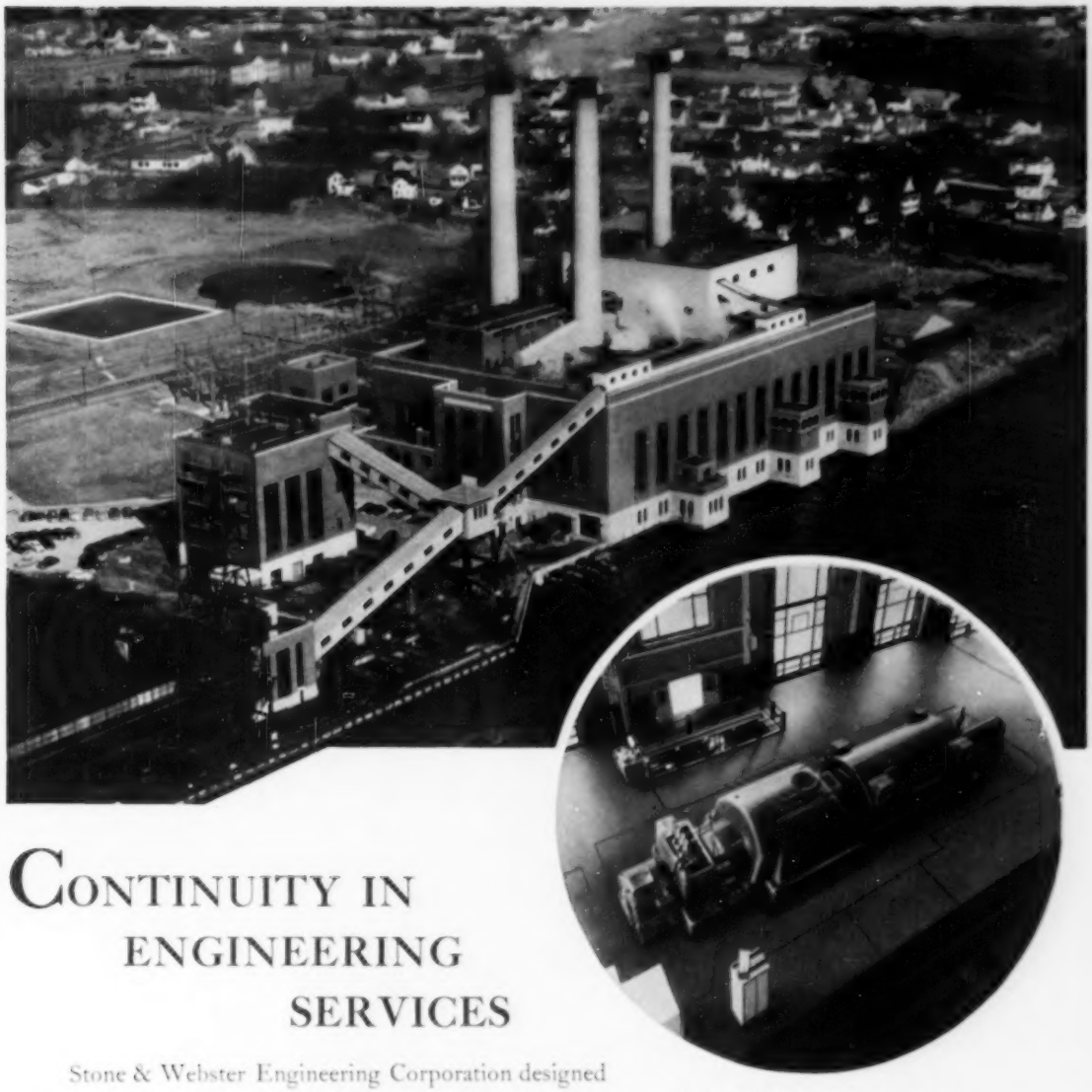
The motor, type H, conforms to NEMA standards and is available in 182, 184, 213 and 215 NEMA frames. Larger ratings will be available soon in the rerated frame sizes.

Complete housing and end brackets of the totally enclosed motor are constructed in solid cast iron ribbed frame.



General Dynamics Corp, Electro Dynamic Division, Bayonne, N. J.

(More New Products on page 157)



CONTINUITY IN ENGINEERING SERVICES

Stone & Webster Engineering Corporation designed and constructed the first unit of Somerset Station for Montaup Electric Company at Somerset, Massachusetts in 1924. Three years later the Engineering Corporation designed and built a second unit; in 1942 the first large high pressure controlled circulation boiler in this country and a third unit were installed; in 1947 a fourth unit was added and a fifth unit is now on the line.

Four-fifths of all the construction work of the Corporation amounting to well in excess of three billion dollars has been in the form of "repeat orders" from clients.

With the fifth unit shown above, Somerset Station has a net capability of 215,000 kilowatts

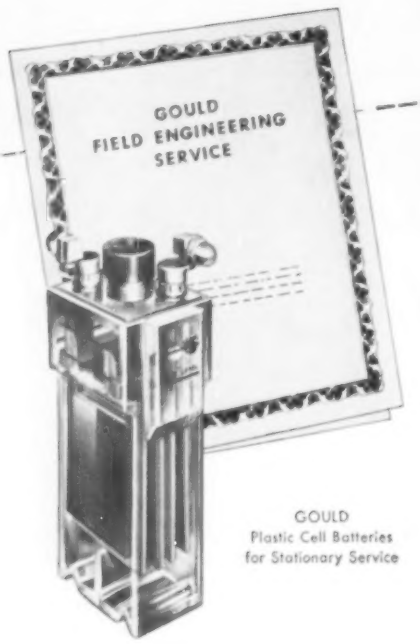
Write or call us for detailed information as to how our engineering, design, construction, report and appraisal services may be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

"Best Operating Insurance Money Can Buy"



GOULD
Plastic Cell Batteries
for Stationary Service

When you buy a Gould Research-Built Battery, you not only get the finest battery modern science can give you . . . you get also the finest, nation-wide field engineering service in the industry.

Strategically located in all principal cities, Gould Field Engineers are as near to you as your telephone . . . ready to help you get greatest possible service from your batteries and keep your facilities in operation. Through educational work with your maintenance staff, advice on selection and anticipation of battery needs and actual emergency servicing of batteries, your Gould Field Engineer is perfect operating insurance.

Call him in. You'll find it the best move you ever made. Don't forget to ask him for the new Gould Plus-Performance Plan material for your maintenance staff.

Always Use Gould-National Automobile and Truck Batteries

GOULD
Batteries

GOULD-NATIONAL BATTERIES, INC.
TRENTON 7, N. J.

"BETTER BATTERIES THROUGH RESEARCH"

©1955 Gould-National Batteries, Inc.

MORE NEW PRODUCTS

General Motors Corp, Delco-Remy Division, Anderson, Ind., has introduced a 3-in. **starting motor** for small gasoline engines of up to 40 hp. The 6.5-lb starter, available in 6 and 12-v models, is a 4-pole, 4-brush type, operated by a standard auto storage battery.

Ideal Industries, Inc, 1021 Park Ave, Sycamore, Ill., has introduced a current-limiting **voltage tester.** Model 61-007 features current-limiting resistors, wire wound and ceramic insulated, which are built into each test prod to limit current in the leads to 1 amp at 250 v.

American Blower Corp, Detroit 32, Mich., has a line of central station type sprayed coil **dehumidifiers** in standard arrangements having 1-3 coils high and 4-8 coil rows deep. The units have finned tube length of 2-10 ft, coil face area of 4-83 sq ft, and capacity of 2,300-45,900 cfm.

Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y., has a **centrifugal pump** that handles liquids containing high concentrations of solids, air and gases. It is available in 4-12-in. sizes with 200-7,000-gpm capacities and 5-225-ft heads.

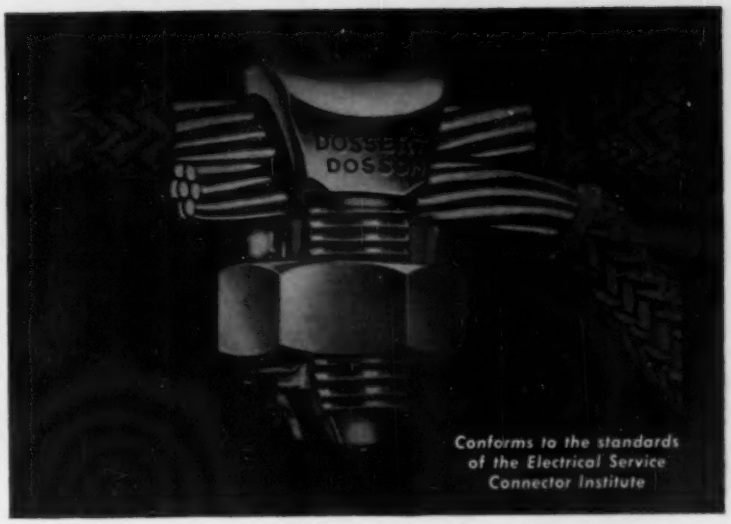
Furnas Electric Co, 1000 McKee St, Batavia, Ill., has an electric motor **starter coil** with a dual voltage feature. The unit is protected by fungus-resistant epoxy resin.

Bentley, Harris Mfg Co, Conshohocken, Pa., has tracer stripes on vinyl-coated and silicone rubber coated fiberglass sleevings for **electrical insulation.** Nine colors, 81 color code combinations are available.

Walter Kidde & Co, Inc, Belleville, N. J., has introduced a line of wet chemical portable **fire extinguishers** in pressurized and brass container units, available in 1 and 1½-qt and 1, 2½ and 5-gal sizes.

Allen B. Du Mont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J., offers **two-way radio** units for communication with mobile vehicles in industrial plants. Two models cover the frequency ranges of 25-54 Mc and 144-174 Mc.

(*Continued on page* 158)



DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

Mail coupon for FREE Dosson "F" Connector

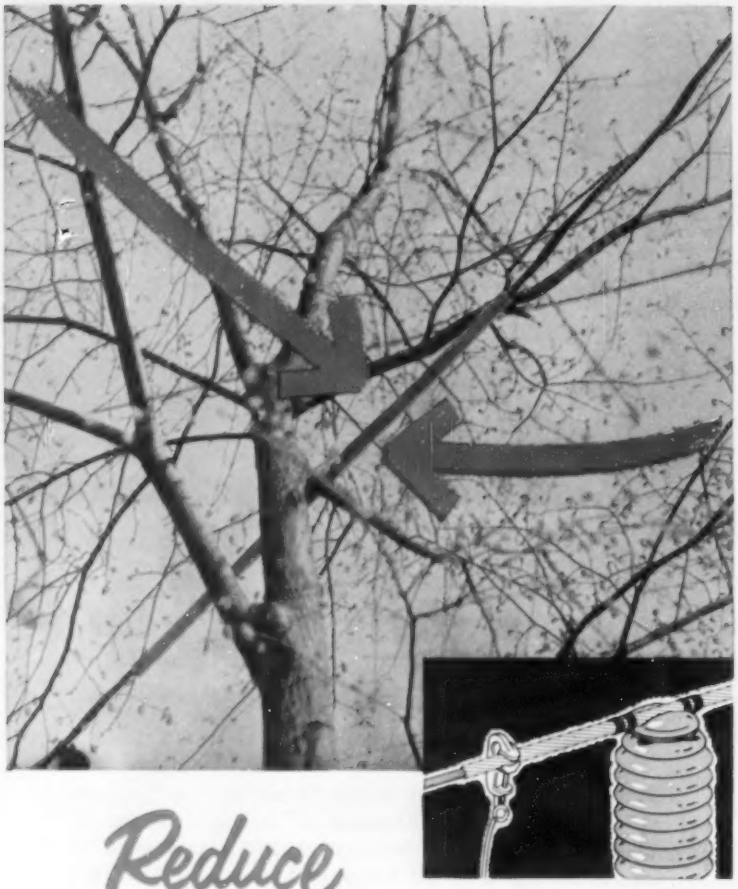
DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:
Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

50 YEARS OF TERMINAL LEADERSHIP

DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.



Reduce

TREE TRIMMING

LINE GUARDS or ARMOR RODS

Line guards, a development from ARMOR Rods are used, like ARMOR Rods, to protect against arcover, chafing and mechanical wear due to concentrated stresses.

Reduce maintenance expense . . . improve customer good-will by protecting your conductor with Preformed Line Guards. Metal or plastic guards available...all are accurately formed to fit snugly without loosening. Easy to install—no tools needed.

These exclusive guards assure positive protection against the abrasive rubbing of tree limbs, corners of buildings, poles and other damaging objects. Dangers of grounding are eliminated . . . insulation life prolonged indefinitely. Conductor maintenance is nil.

For longer care-free service—a greater safety factor, specify Preformed Line Guards.

● *For complete details of their exclusive advantages, write or telephone Cleveland: EXpress 1-3571.*

PLP PREFORMED LINE PRODUCTS CO.
5349 ST. CLAIR AVENUE · CLEVELAND 3, OHIO

More New Products

(*Continued from page* 157)

General Electric Co, Schenectady 5, N. Y., has a **fluorescent lamp ballast** for 240-280-v operation of two F40-T12 lamps. The ballast (No. 89G548) is 1½ lb lighter than the unit it replaces (No. 89G448).

Wheelabrator Corp, 1748 S. Byrkit St, Mishawaka, Ind., has developed a process for super-cleaning atmospheric air with industrial-type **air filtration equipment.** The process may be used in applications formerly employing disposable or viscous filters or low voltage electrostatic precipitators.

Gleason-Avery, Inc, Auburn 1, N. Y., offers a **damper** motor which converts power taken from a pair of highspeed induction motors into lateral motion. No. 311-R is available for 20-v application or higher on 25, 50 or 60 cycles. Minimum mounting space is 5 x 3¾ x 5¼ in.

Acorn Co, 1482 S. Milwaukee St, Denver 10, Colo., has a **heavy equipment dolly** that is 9 in. long, 5 in. high and wide, and weighs 40 lbs. A set of four is said to withstand 90 tons.

Magnetic Amplifiers, Inc, 632 Tinton Ave, New York 55, N. Y. has announced its **variable speed drive** line that covers a range from ¼ to 1½ hp. For further information write for bulletin S580-5-55.

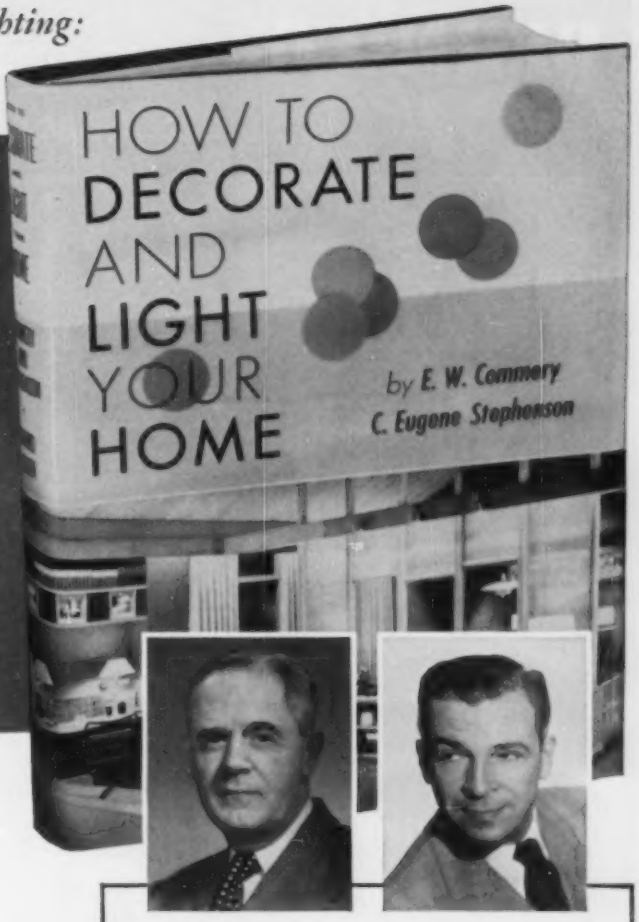
Anaconda Wire & Cable Co, 25 Broadway, New York 4, N. Y., has a line of **telephone wires and cables** including aerial and duct cables, direct burial cables, self-supporting cables, and rural and urban distribution wire. All are color-coded to industry standards.

Stearns Magnetic Inc, Milwaukee 46, Wis., offers the H-1200 **magnetic disc brake** for re-rated NEMA frame sizes in the 50 to 100-hp range. Brake is reported to develop higher torque in less space.

North American Philips Co, Inc, 750 S. Fulton Ave., Mount Vernon, N. Y., has an **x-ray unit** (MG 160-D) that provides 40 or 120 deg apertures. It weighs 143 lb. Power supply is 230 v ac at 10 amp.

Important news about home lighting:

General Electric proudly recommends the first authoritative book ever written combining GOOD LIGHTING AND INTERIOR DECORATION



Here's the new standard handbook on how to use home lighting effectively.
256 pages!
More than 100 drawings!
28 full color sketches!

ABOUT THE AUTHORS: E. W. Commery (*left*), dean of American home lighting experts, Fellow of I.E.S., is in charge of residential lighting for General Electric. C. Eugene Stephenson (*right*) is a nationally-known decorator, twice president, American Institute of Decorators.

THIS is the book that explains the newest concept in decoration and home lighting—how to use lighting as an important and integral part of home design.

It's totally different from any previous work on this subject. Instead of concentrating on a series of pre-conceived rooms, it offers the reader the basic tools of lighting and decoration which can be adapted to any *size or type of home. No other book of this type has ever attempted this.*

When the well-known publishing house of Coward-McCann Inc., decided to bring out a book combining home lighting and decorating, General Electric was pleased and proud that its own E. W. Commery, was chosen as co-author to work with Mr. Stephenson. His 25 years as a residential lighting designer make him well qualified for this valuable contribution.

Subjects covered include: how to create color schemes; how to group furniture and make best use of walls, windows, ceilings and floors; how to select and arrange accessories; how to assemble finished rooms; how to make the most of patios and terraces.

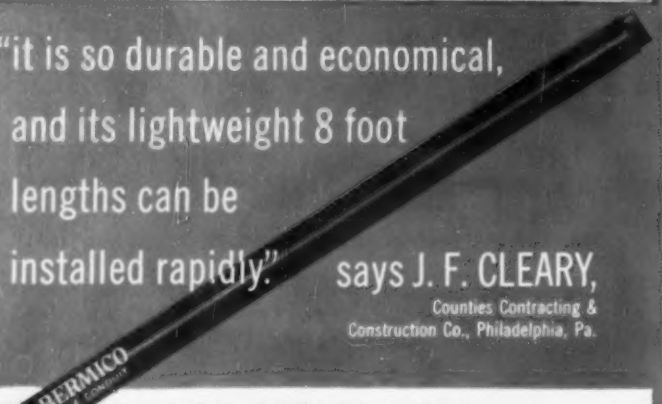
Whether you're planning new homes or modernizing old ones, you'll find "How to Decorate and Light Your Home" full of valuable information. Take advantage of the pre-publication price of $5.75, after December 31—$6.75. Get a copy today from your local bookstore. Large Lamp Dept., General Electric Co., Nela Park, Cleveland 12, Ohio.

GENERAL ELECTRIC

BERMICO® electrical conduit to carry 13,000 volt cables because . . .

"it is so durable and economical, and its lightweight 8 foot lengths can be installed rapidly." says J. F. CLEARY,

Counties Contracting & Construction Co., Philadelphia, Pa.



A total of 25 miles of Bermico Conduit will soon be running beneath the streets of Baltimore, between Baltimore Gas & Electric's Center and Woodbrook Substations. Of fifteen lines connecting the points, three will be used at once, the others as power needs grow.

Precisely engineered Bermico Conduit is made of wood cellulose impregnated with pitch. It resists alkalies and acids, stays tight and strong. It is completely uniform. Low in cost, it installs quickly and easily.

No wonder so many leading electrical contractors specify Bermico, for every type of soil from coast to coast.

Immediate shipment of all sizes and fittings is guaranteed.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

Berlin, New Hampshire

GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.

SOLKA PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOTTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE AND CONDUIT • ONCO DYSTUFFS • CHEMICALS

CATALOGS—BULLETINS

● **LIGHTING:** A complete line of commercial, institutional, industrial and outdoor lighting fixtures is covered in a 64-page catalog. Each unit is described and illustrated. Distribution curves and installation details are included. An added section explains fundamentals of light control and gives recommended illumination levels and lighting design data. Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y.

● **MOBILE RADIO:** Two-way radio units are the subject of Bulletin E-131. It is designed as a guide for selecting frequencies, types of power supplies, types of mounting and transmitter power outputs. Motorola Communications & Electronics, Inc, Technical Information Center, 4501 Augusta Blvd, Chicago 51, Ill.

● **ELECTRIC RESISTANCE WELDING:** Industrial applications, manufacture and service, principles of operation, and types of electric resistance welding machines are the four sections of 12-page Bulletin 333. Sciaky Bros, Inc, Dept L-5, 4915 West 67th St, Chicago, Ill.

● **OVERHEAD MATERIALS HANDLING:** Engineering and application data on overhead materials handling equipment are featured in Booklet 2008-L (12 pages). Installations and equipment details are covered. An analysis of stresses in types of overhead tracks is provided, and track peening is discussed. Cleveland Tramrail Division, Cleveland Crane & Engineering Co, Wickliffe, Ohio.

● **AUTOMATIC FLOODLIGHTING:** Descriptions, suggested uses and installation recommendations for five models of automatic emergency lights are given in a 4-page folder, Form No. AEL-655. U-C Lite Mfg Co, 1050 W. Hubbard St, Chicago 22, Ill.

● **PIPE TOOLS:** A revised catalog presents recent changes in a line of threading, cutting and grooving equipment. Form QR 1055 in eight illustrated pages lists specifications and prices of the product line. A new project, an abrasive cutting machine, is introduced. Beaver Pipe Tools, Inc, Warren, Ohio.

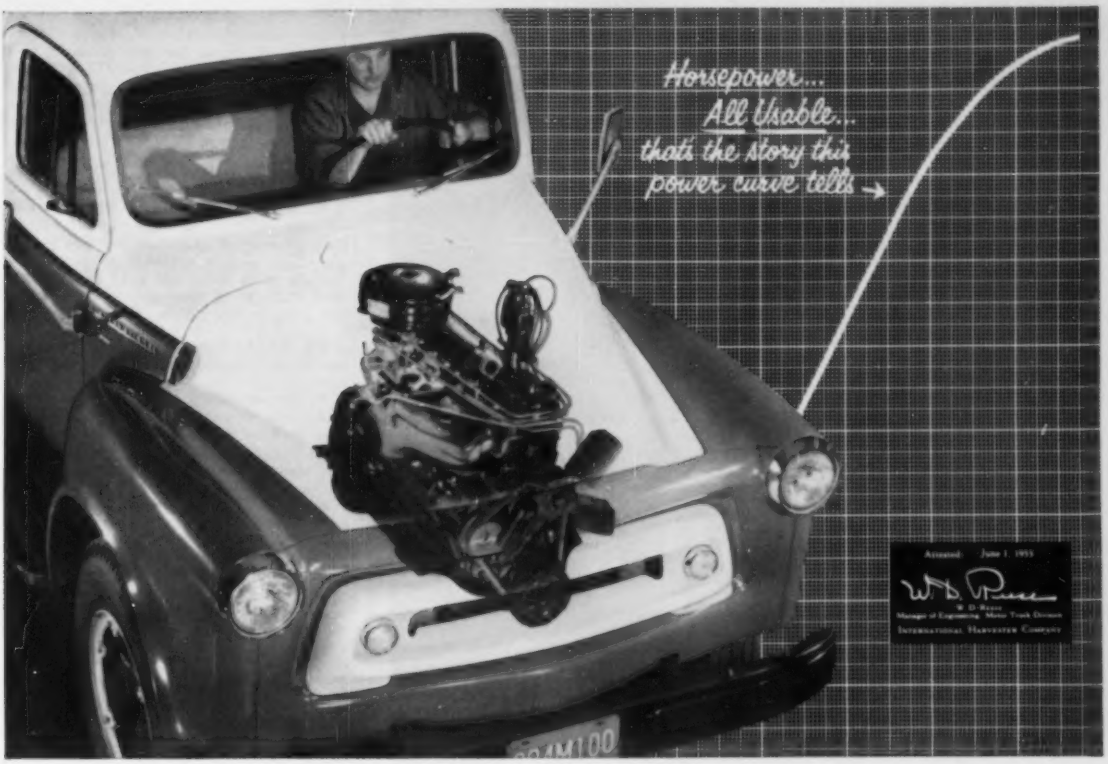
● **ELECTROSTATIC NEUTRALIZERS:** Technical Bulletin No. 126 describes operation principles of a line of electrostatic neutralizer (induction type) bars for eliminating static charges from paper, textiles, plastics and other materials. Installation details are included. Herman H. Sticht Co, Inc, 27 Park Place, New York, N. Y.

● **THERMOCOUPLES:** Design and selection of thermocouples for liquid, gas and surface measurements are covered in Bulletins 1601, 2, 3 and 4, totaling 14 pages. Outline drawings of standard units, information on conductors, junctions, tubes and other engineering data are included. Revere Corp of America, Wallingford, Conn.

● **STORAGE TANK VENTING:** Principles of venting flammable liquid storage and process tanks for effective operation, fire protection and low-cost maintenance are described in a 12-page booklet, titled "Venting Fundamentals," illustrated with photos and diagrams. Protectoseal Co, 1920 S. Western Ave, Chicago 8, Ill.

(Continued on page 162)

It's usable horsepower that counts!



Internationals give you power without strain at safe, economical rpm to save you the BIG money!

Rated horsepower figures don't tell the whole story of truck performance.

Wise truck buyers want to know *more* than rated horsepower. They want to know what actual *usable* horsepower they are going to get to pull capacity loads at normal, legal speeds—without undue engine strain.

Usable horsepower—that's the point to keep in mind when buying trucks.

INTERNATIONAL engines deliver high usable horsepower at economical, wear-reducing speeds. Because they are built for use in *trucks*, with no compromise with passenger car design.

You get the usable power you need, plus longest truck life, every driver comfort and convenience. See your INTERNATIONAL Dealer or Branch for trucks exactly right for your job—all-truck built to save you the BIG money.

INTERNATIONAL HARVESTER COMPANY · CHICAGO

Many passenger car type truck engines have to rev up to high speeds to pull their loads. They strain at the job—cost big money in wear and repair. INTERNATIONAL all-truck engines turn at relatively low rpm—deliver high usable horsepower at normal road speeds, for peak performance, long life, BIG money savings.

In the world's most complete truck line, there are trucks for every public utility job. Eight light-duty models with Service-Utility body, 3 four-wheel-drive models, 9 medium-duty and 15 heavy-duty chassis. Every other truck type, in variations for every need.

INTERNATIONAL TRUCKS

All-Truck Built to save you the BIG money!

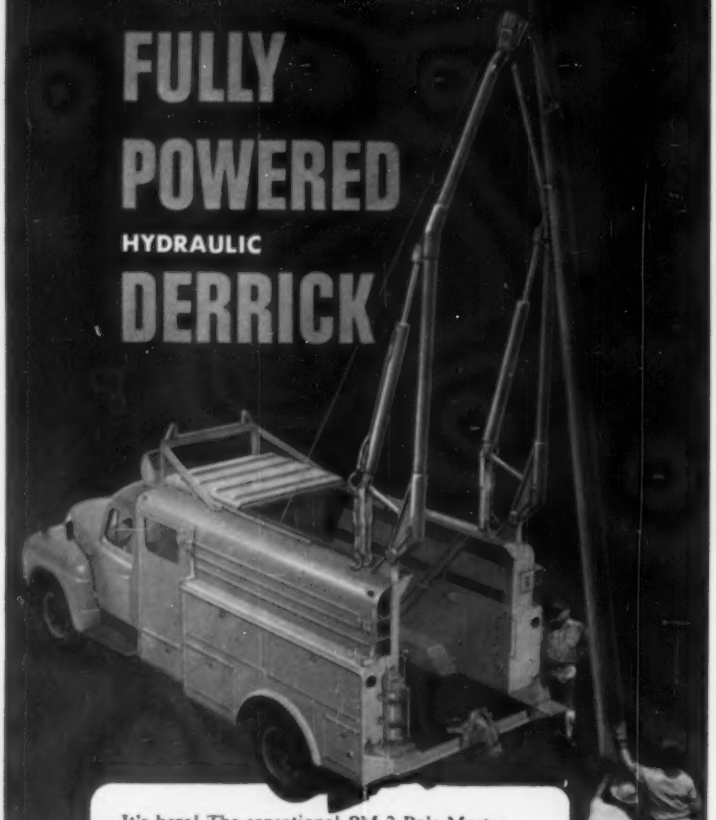
Motor Trucks • Crawler Tractors • Industrial Power
McCormick® Farm Equipment and Farmall® Tractors

POWERS American

PRESENTS THE PM-2

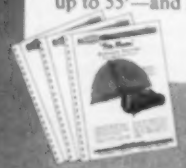
Pole-Master

FULLY POWERED HYDRAULIC DERRICK



It's here! The sensational PM-2 Pole-Master . . . with an operating arc *well in excess* of 180 degrees. "Live boom"—actuated by twin hydraulic cylinders—can be moved under load. Head sheave can be threaded from ground. Stows *completely* out of the way . . . without obstructing body load area or roof. Always ready for use *instantly*, at the flick of a single-lever control.

In three sizes . . . for poles up to 40′—for poles up to 55′—and for poles up to 70′—installed on a Powers-American Line Body that's right for *your* job.



Bulletins describing Pole-Master Derricks—Series PM-2, Series HD-2, and Series HD-4—will be sent, with price information, upon request. No obligation, of course!

McCABE-POWERS AUTO BODY COMPANY

3900 NORTH BROADWAY • ST. LOUIS 15, MO. 625 CEDAR ST. • BERKELEY 10, CALIF.

Catalogs—Bulletins

(Continued from page 160)

● **MOTORS AND DRIVES:** A line of special and standard motors and adjustable speed drives for the machine tool industry is described in Bulletin No. 1750. Technical data on electrical features and illustrations of installations are included in the 12-page booklet. Louis Allis Co, Milwaukee 7, Wis.

● **TUBING SUPPORTS:** Bulletin 955-D covers a line of support structure for individual or bundled tubing and cable. The 16-page booklet includes specifications, descriptions and drawings of straight sections, connectors, extension connectors, fittings and other support equipment. P-W Industries, Inc, Duncan & Melrose Sts, Philadelphia 24, Pa.

● **GE BULLETINS:** The following are available from General Electric Co, Schenectady 5, N. Y.:

Switchboards are described and illustrated in 40-page Bulletin GEA-4127B. The booklet shows how 8 classifications of standard switchboards are constructed, operated and tested. Basic circuit specifications are included.

Control transformers including autotransformers, machine tool transformers, and units for special applications are covered in Catalog GED-2767. The 32-page booklet contains ratings, dimensions, product features, model numbers, list prices, weights, wiring diagrams, and panel and machine tool voltage regulation curves.

● **MOTORS & GENERATORS:** Engineering, methods, and testing applied to a line of motors from 1/20 to 2,500 hp and generators from ½ to 2,000 kw are covered in the booklet, "A Company with a Future Invites You." Illustrated in color, the booklet describes dripproof, splashproof, weather protected, totally enclosed and explosion proof motors. Marathon Electric Mfg Corp, Wausau, Wis.

● **TIME DELAY RELAYS:** Selection information for a line of time delay relay models is contained in 4-page Bulletin SD-1. A selection chart lists method of adjustment, operating voltage, type of operation, contact arrangement, type of contact, dimensions and weight for each model. Various mountings and enclosures are shown in diagrams. A-G-A Division, Elastic Stop Nut Corp of America, Elizabeth, N. J.

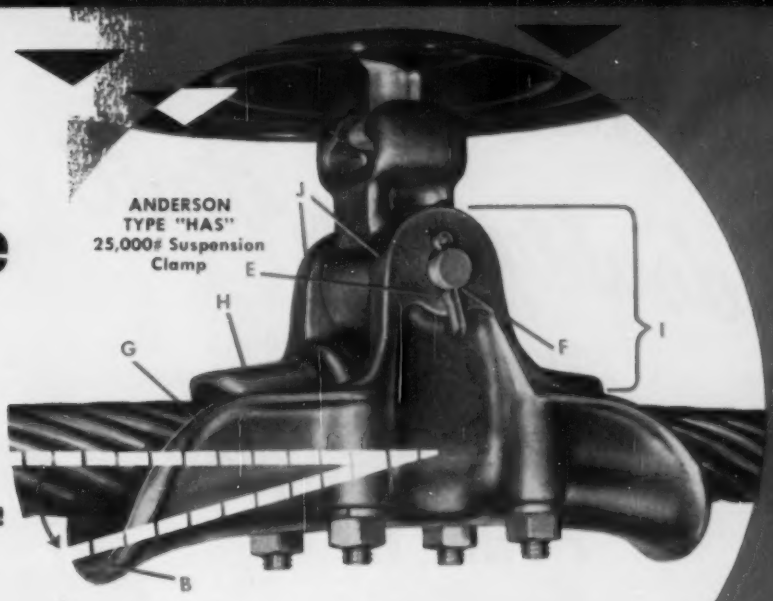
● **MOBILE CRANES:** A line of mobile cranes is described in an 8-page bulletin. Photographs illustrate specific uses. Specifications, lifting capacities, and descriptions of power package, construction, and safety features are included. Coles Cranes, Inc, P. O. Box 942, Joliet, Ill.

● **PLASTICS AND RESINS:** A revised "1956 Condensed Reference File of Bakelite Plastics and Resins" presents latest information about properties and uses of these materials. The 12-page booklet summarizes technical data on more than 50 plastics and resins. Bakelite Co, a division of Union Carbide & Carbon Corp, 300 Madison Ave, New York 17, N. Y.

● **TIERING TRUCK:** An electric straddle-type tiering truck is described in 2-page Bulletin 831. Specifications and photographs of the 4,000-lb truck are included. Raymond Corp, 144-137 Madison St, Greene, N. Y.

New SUSPENSION CLAMP

...the result of a nation-wide utilities survey



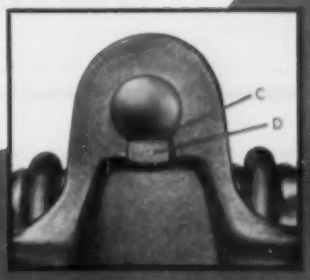
POWER LOSS PRACTICALLY ELIMINATED!

Deep, flared cable groove at mouth with extra built-in strength provides for *dual use* . . . suspension as well as angle pull-off! Turning angles on all sizes permit widest range of conductor sags. Light weight to reduce conductor damage.

HAS*. . . TYPE AND SIZES

Catalog Number	Min. Groove Diameter	Max. Groove Diameter	Ultimate Strength in Lbs.
HAS-85-S	.40	.85	17,000
HAS-104-S	.50	1.04	25,000
HAS-118-S	.70	1.18	25,000
HAS-129-S	.90	1.29	25,000
HAS-139-S	.90	1.39	25,000
HAS-147-S	1.00	1.47	25,000
HAS-162-S	1.10	1.62	25,000
HAS-182-S	1.25	1.82	25,000
HAS-204-S	1.40	2.04	25,000
HAS-227-S	1.75	2.27	25,000
HAS-252-S	2.00	2.52	25,000
HAS-252-16S	2.00	2.52	30,000

*Available through insulator manufacturers



Note carefully the specific features engineered into these newly developed Anderson Suspension Clamps:

(A) Correct conductor approach angle with keeper and bottom of groove . . . prevents crystallizing damage due to conductor vibration.
(B) Shape of mouth flare provides proper approach angle with the sides of clamp . . . for wide range of sagging tensions.
(C) & (D) Anti-rotation lug, with seat . . . prevents wear in the aluminum clamp ears.
(E) & (F) "Humped" speed cotter key remains tight in clevis pin hole . . . preventing wear and reducing Radio and TV interference.
(G) Minimum clearance between conductor and clamp . . . increases protection of conductor.
(H) Non-ferrous keeper . . . prevents electrolysis and further reduces power loss.
(I) Short clamp ears . . . reduce overall assembly length and allow damaging vibration to pass through.
(J) Heavy ear section.

For more complete performance . . . including engineering and design data, use charts and other particulars . . . consult your nearest Anderson Representative, or write to our home office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION

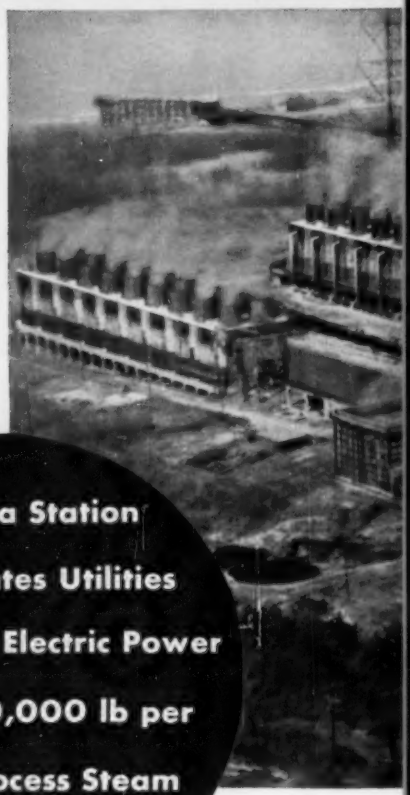
ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

Utility provides both steam

This Fact Makes It *doubly important*

That Switchgear Provide Uninterrupted Power for Auxiliaries



Louisiana Station of Gulf States Utilities Co. Provides Electric Power plus 3,000,000 lb per hour of Process Steam for Industry

TWO lineups of Allis-Chalmers station auxiliary switchgear are used in this plant. Engineered by Stone and Webster, it is one of the largest steam plants in the United States. Since much of the process steam is supplied to refineries, the load factor is high and the need for continuity of service of the station auxiliaries is especially critical. Gas is used as the principal fuel.

There are 12 turbine-generators in the plant. This division of the load is, of course, an important factor in continuity of electrical service. In addition, the electrical schemes used assure an uninterrupted power source for auxiliaries.

There are 13 units in one of the lineups of Allis-Chalmers switchgear and 28 units in the other. A brief description of the new 28-unit lineup in the new plant extension will illustrate the planning employed.

The 28 switchgear units are made up into three bus sections, with each section controlling auxiliaries for a separate boiler.

Under normal operating conditions each bus section is energized by its respective transformer. Tie breakers between the sections are open.

But in the event of trouble any two of the three transformers can feed all three bus sections.

On each bus section there are: one boiler feed pump, two forced draft fans, and two induced draft fans. In addition, there is a fourth boiler feed pump on one bus section which can take the place of any of the other three boiler feed pumps. In the event of failure of either one of the two forced draft or induced draft fans, the remaining fans would enable the boiler to carry half its normal load.

Overcurrent relays on all feeders and bus tie breakers will trip and lock out associated circuit breakers and close an annunciator contact for alarm. Long time overcurrent relays are used on motor feeders.

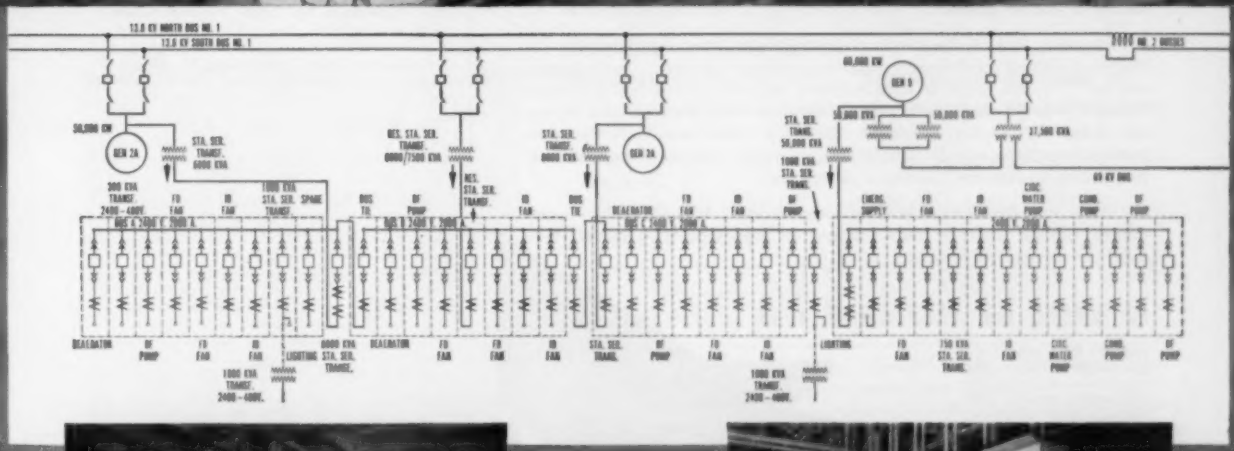
Interlocking in switchgear assures proper sequence of operation of auxiliaries.

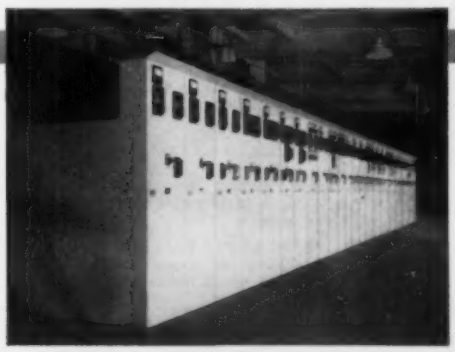
★ ★ ★

Allis-Chalmers engineers worked in close cooperation with both Stone and Webster and Gulf States Utilities Company engineers. This is one of many auxiliary lineups built by Allis-Chalmers. For information about Allis-Chalmers switchgear, call your nearby A-C office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4791

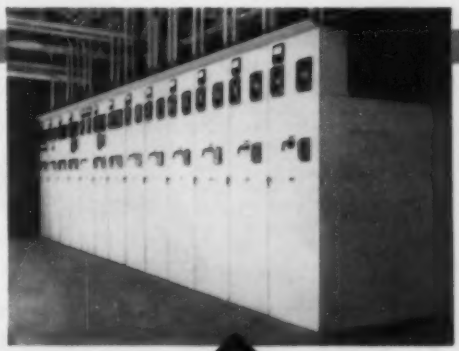
ALLIS-

and electricity for refineries





Special drip-proof design was furnished for both lineups of Allis-Chalmers Metal-Clad Switchgear.



CHALMERS

A-C ALLIS-CHALMERS

If you want to know why fine FANNER ARMOR RODS are "superformed", look closely at the details of construction . . . because it is the details which make a difference to the line and the lineman . . . it is the details which denote a quality product.

For example, look at the clean, smooth rounded ends that eliminate the danger of nicking conductors or scratching linemen's hands . . . that minimize corona . . . and result in tight, tailored, form-fitting line reinforcements. Notice how every rod is exactly like every other rod of the same size regardless of the "lot", so that all can be matched in perfect sets. Fanner's manufacturing methods provide unvarying consistency of product dimensions to insure that all lots are identical and uniform.

For armor rods that always start right and end well — use FANNER Superformed ARMOR RODS — they cost you no more than other types! Write today for descriptive literature.

PACKAGED for PERFECTION, too!

FANNER Superformed Armor Rods are protected from end to end in sturdy full length cartons with contents fully identified. Rods stay clean, new and undistorted — *right up to the very minute they are used!* At slight extra cost they are also banded in sets of the proper number with extra-strength identifying tape that prevents breakage in shipping or handling — another feature that saves time, money and eliminates waste. It pays to use "FANNER"!

Licensed for use under Patent No. 2,275,019

Fine Fanner Superformed

THE FANNER MANUFACTURING CO.

Brookside Park • Established 1894 • Cleveland 9, Ohio

AGENTS IN PRINCIPAL CITIES

ARMOR RODS • TAP ARMOR • LINEGUARDS • PATCH RODS

TECHNICAL LITERATURE

AIEE STANDARDS—Following publications were issued recently by American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.:

● Standard, Test Code and Recommended Practice for Induction and Dielectric Heating Equipment, No. 54. Contains standards for service conditions, rating of oscillators, converters and power supplies, temperature rise and dielectric tests, nameplates, equipment, and auxiliaries. Covers installation, operation and maintenance of rotary spark gap and vacuum tube equipment. Price 80¢.

● Proposed Test Code for Power Factor Testing of Distribution Transformers, No. 506. Covers instruments, testing procedure, temperature correction factors, and power factor values. No charge.

● Committee Report on a Guide for Evaluating the Effect of Solar Radiation on Outdoor Metal-Clad Switchgear, No. 955. Deals with operating limitations, external influences on internal operating temperatures, ventilation, current-carrying capabilities, and suggested modifications of standard designs of switchgear. A chart lists average daily highest temperature by months for 200 cities in the U. S. No charge.

● Proposed Test Procedure for Evaluation of the Thermal Stability of Enameled Wire, No. 57. Covers insulation test specimens, test exposures, voltage checks, and reporting test results. No charge.

● American Standard for Electric Control Apparatus for Land Transportation Vehicles, AIEE No. 16, ASA C48.1. Covers service conditions, definitions and terminology, and performance requirements of control apparatus for all land transportation vehicles. Price 60¢.

EEI REPORTS—Following reports were published recently by Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.:

● Hydraulic Turbine and Draft Tube Settings, No. 55-9. This report of the EEI Hydraulic Power Committee summarizes various factors involved from a practical operating standpoint. Methods used by two manufacturers for preliminary determination of size, speed and setting of Francis turbines are described. Recommended setting for regulating units and means for depressing tailwater are included. Price $1.00 to non-members in U. S.

● Substation Loading by Thermal Capability, No. 55-19. This report of the EEI Electrical Equipment Committee deals with thermal rating of substations, loading of distribution substations, and selection of power transformers for use in metropolitan substations. Price $1.50 to non-members in U. S.

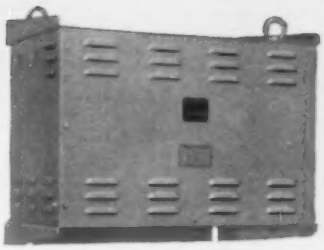
BOILER TUBE CORROSION—Eleven ways to avoid boiler tube corrosion are discussed in Bulletin TR-537. Babcock & Wilcox Co, Tubular Products Division, Milwaukee, Wis.

ASTM STANDARDS—Sixth edition of "ASTM Standards on Paper and Paper Products and Shipping Containers (with Related Information)" is available. Total of 101 designations are included. There are five new and ten revised standards and four new appendices since previous (1953) edition. Heavy paper cover, 406 pages, price $3.75. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

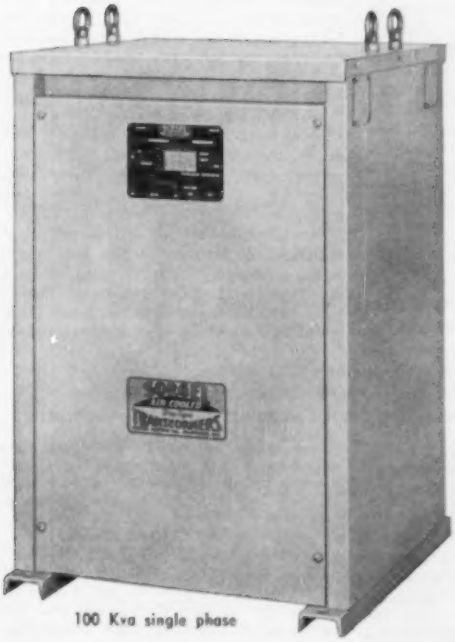
TRANSFORMERS

To change higher voltage distribution service to lower voltage lighting and power circuits

¼ Kva single phase 480/240 to 240/120 volt



15 to 50 Kva 3-phase wall mounting type



100 Kva single phase

SORGEL AIR-COOLED DRY-TYPE TRANSFORMERS

are the most practical type for indoor installations

Requiring no oil or liquid, they can be installed in almost any convenient place inside of buildings, without fire-proof vaults or other enclosures, and meet the requirements of the National Electrical Code. This eliminates the necessity of long runs of secondary feeders and reduces installation and wiring costs.

The transformers can be installed at load centers, using higher voltage feeders, requiring smaller copper, increasing efficiency, improving voltage regulation and reducing losses. They require no maintenance or further attention after installation.

Easy installation, easy connecting, rugged construction, low noise level.

TYPICAL APPLICATIONS

Sorgel Air-Cooled Dry-Type Transformers are used to:

- Operate 120 volt lighting and portable equipment from 240, 480 or 600 volt power circuits.
- Supply more than one voltage from a single voltage system.
- Change odd voltages to standard voltage.
- Phase changing.
- For high voltage interior distribution systems of 2400, 4160, 4800, 7200, 13,200 and up to 15,000 volts.
- For substations and load centers.

Tested and approved by Underwriters' Laboratories under the Re-examination Service

Complete line

¼ Kva to 2500 Kva single phase. 1 Kva to 3000 Kva 3-phase, 2-phase, and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200 and up to 15,000 volts, and any intermediate or special lower voltage.

Also Special Transformers and Saturable Reactors

Stock carried by jobbers in the following cities:

New York, N.Y.	Chicago, Ill.
Buffalo, N.Y.	Rockford, Ill.
Roxbury, Mass.	Rock Island, Ill.
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Raleigh, N.C.	Omaha, Neb.
Philadelphia, Pa.	Davenport, Iowa
Cincinnati, Ohio	Cedar Rapids, Iowa
Cleveland, Ohio	Beaumont, Tex.
Louisville, Ky.	Los Angeles, Calif.

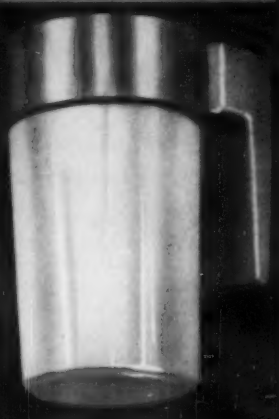
Consult the classified section of your phone directory, or write to the factory

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

design by mc Philben



A Vapor-Tight Wall Bracket

dynamically new . . . obsoletes all old wall brackets!

If a utility man went into the lighting fixture business, we'd like to think he'd like to work for McPhilben. Why? Because so many of the practices we follow, so many of the principles we live by . . . these are the standards the electric utilities have always fought for in their efforts for better lighting.

Note our emphasis on "design by McPhilben". And here design means *maximum fitness for purpose* . . . the right materials, construction, utility, ease of maintenance, appearance—and cost, too.

A classic example—McPhilben's new multi-use wall bracket (43-46 VT) shown above. Beautifully honest of design, rugged of die cast aluminum, vapor-tight, and versatile for so many applications—in home, business and industry. We feel any utility man would be proud to recommend it.

What would you like to know about McPhilben, and the most progressive line of fixtures in lighting?

DIE CAST PROTECTIVE GUARD AVAILABLE (43-44VT) for locations where protection against theft and vandalism is essential. Also available as a ceiling fixture.

1347 Willoughby Avenue, Brooklyn 37, N. Y.

CONSULT mcPhilben Lighting SPECIFY

Representatives in major cities
Stocked By Electrical Wholesalers

BOOKS

Engineering for High Voltage

Einfuhrung in die Hochspannungstechnik. By M. Wellauer. Published by Verlag Birkhauser AG, Elisabethenstrasse 15, Basel, Switzerland. 328 pages, illustrated. Price S Fr 26.95.

More than its title implies, this book is an excellent reference in high-voltage engineering. Extensive material is included about insulation coordination, impulse strength, and surge protection. And copious illustrations contribute to its coverage. The author has contributed materially by his grouping of subject matter and a complete index. And an extensive bibliography assists in further study of any particular phase of the field.

This book should be helpful to younger engineers moving into the high-voltage field and seeking to acquire knowledge of its techniques.

How to Test Meters

Prufung der Elektrizitatszahler. By K. Schmiedel. Published by Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 243 pages, illustrated. Price DM 24.50

This book is written to provide the meter engineer a comprehensive survey of all known methods and devices for testing and adjusting electric meters. The 4th edition includes the more accurate modern meters, recognizing that error in testing methods for them cannot exceed one-tenth the error of the meter. Methods include relating ac measurements to dc for more accurate comparison with precision standards, and use of electronic oscillators for timing the test period. Older methods are covered briefly.

Even though equipment described is undoubtedly German, the American meter engineer should benefit by study of the methods and philosophy in this well-illustrated reference book.

Making New "Ops"

Radio Operating Questions and Answers. By J. L. Hornung and A. A. McKenzie. Published by McGraw-Hill Book Co, 330 W 42nd St., New York 36, N. Y. 571 pages, illustrated. Price $4.50.

This book (12th edition) is a must for prospective radio operators preparing for FCC License examination. All material contained is in the form of straightforward questions and answers with appropriate illustrations to supplement the text.

New sections have been added, and others revised, to keep pace with FCC's latest Study Guide and Reference Material for Commercial Radio Operators Examinations. Overall more than 1,900 questions cover such topics as frequency modulation, monochrome and color television, radio-telephone and telegraph communication, broadcasting law, transistors, waveguides and reduction of noise. Appendixes are devoted to Q codes, time signal information, word lists, and resistor and capacitor color codes.

Aside from being very useful for the FCC examination, this book will also serve as a handy reference for licensed operators or as a text on radio theory and operation. It is of interest to utilities as a text for training operators for their radio and microwave stations.

How to Use Transistors

Transistor Audio Amplifiers. By Richard F. Shea. Published by John Wiley & Sons, Inc, 440 4th Ave, New York 16, N. Y. 231 pages, illustrated. Price $6.50.

In seven years since transistors emerged from discovery shrouded in wartime secrecy, they have moved rapidly into commercial use. But many experienced engineers, even with backgrounds in vacuum-tube electronics, hesitate to use transistors because their knowledge of requirements is limited. This book offers these engineers the basic fundamentals of transistor applications at audio frequencies so they can apply them intelligently, avoid pitfalls, and achieve the ultimate performance.

Profusely illustrated with performance characteristics and typical circuitry, the book generally avoids higher mathematics. Necessary network theory is provided. And the effects of temperature, interstage coupling, and operating points are analyzed.

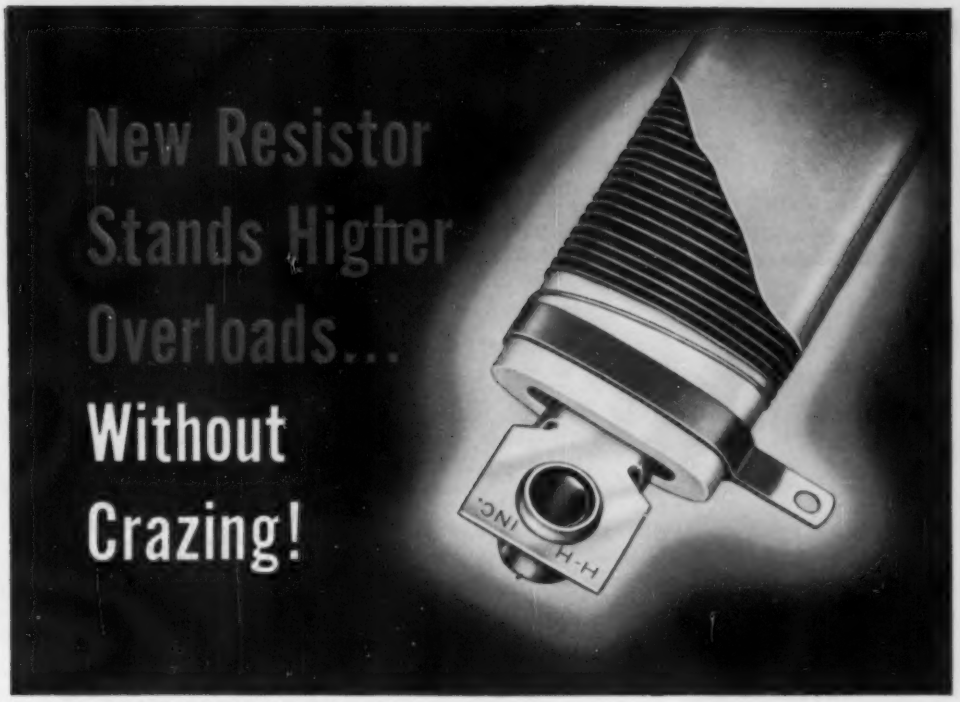
Application in the utility industry would seem limited to the few engineers who apply electronics to control, relaying, and communication facilities. But to these engineers the book would be a timely text and reference.

A Guide to Motor Maintenance

Connecting and Testing Direct-Current Machines—3rd Edition. By F. A. Annett and A. C. Roe. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St., New York 36, N. Y. 313 pages, illustrated. Price $5.00.

This book consists of two distinct parts, one dealing with reconnecting direct-current machines for a change in voltage or speed or both, and the other with locating and remedying faults. Each section can be used independently of the other. This 3rd edition includes material on the many improvements that have been made recently in insulations and testing methods, with special attention to techniques of high-frequency, low-energy, surge-voltage testing.

(*Continued on page* 170)



The "Blue Ribbon", resistor with a higher wattage rating per unit space requirement. Made by Hardwick, Hindle, Inc., Newark, N. J.

because of DRIVER-HARRIS 146 ALLOY

Here is a resistor really new and different . . . the compact Hardwick, Hindle "Blue Ribbon," which stands remarkably high overloads and excessive heat without crazing.

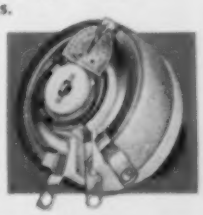
Special design features which make this possible are: an aluminum thru-bar extending through the center of the elliptical ceramic core, which insures a more even distribution of heat to prevent "hot-spots;" and a thermo-shock-proof enamel coating which eliminates crazing.

Heretofore, crazing, which occurred mostly at *terminal* areas, shortened resistor life and limited the safety factor. To prevent this, an alloy with three hard-to-find qualities was needed: (1) It had to have a coefficient of expansion to match all integral parts; (2) it had to be free of gas; (3) it had to form a perfect bond with the enamel.

A large order, indeed. But Driver-Harris filled it by developing #146, a glass-to-metal sealing Alloy. This alloy now makes it possible to operate resistors and rheostats at hitherto dangerous overloads, with no risk of breakdowns in the enamel coatings.

146 Alloy is one of 4 Driver-Harris Alloys which cover most glass-to-metal sealing needs—available as rod, wire, strip, sheet foil, and in special shapes. Today the makers of the "Blue Ribbon" use 146 Alloy for the terminals in all of their resistors and rheostats as well. They also use Nichrome*, Advance*, and other gas-free resistance alloys made by Driver-Harris in winding the cores.

What you can learn from this is clear. If you also need a special purpose alloy, send us your specifications. Our engineers with 48 years of experience are at your service.



One of a new line of "H" Series high wattage rheostats made by Hardwick, Hindle, using Driver-Harris Alloys.

*T. M. Reg. U. S. Pat. Off.

Nichrome and Nichrome V are made only by

Driver-Harris Company HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Louisville, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario

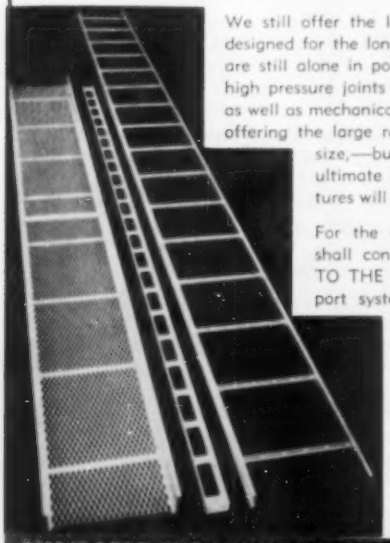
MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

We are followed

We are proud to be considered the leaders in our field. We specialize in electrical cable support systems and are slowly followed by all others in:

1. The longer lengths we pioneered for field labor savings.
2. The slip-on expanded metal splices originated by us for lower erection costs.
3. The use of structurally sound racks with fully inserted and welded rungs.
4. The principle of designing for long spans to save supports.
5. The use of aluminum to reduce the "installed cost" and give a "maintenance free installation."



We still offer the longest racks, troughs and baskets designed for the longest spans and heaviest loads. We are still alone in pointing out the great importance of high pressure joints for splices to give sound electrical as well as mechanical connections and are also alone in offering the large radii fittings suitable for any cable size,—but hope that, for the benefit of the ultimate user, these and all our other features will also soon be copied.

For the convenience of our customers we shall continue to feature the "COMPLETE TO THE LAST BOLT" electrical cable support system including time-saving installation tools, will continue to help the contractors with lay-outs, take-offs and erection diagrams and will continue to excel in delivery and service rendered. "HUSKY DOESN'T COST—IT PAYS."

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.

5300 VINE STREET, CINCINNATI 17, OHIO

BOOKS

(*Continued from page* 16)

Text is well written. It is up-to-date, thorough, and well organized. Illustration material is exceptionally good, especially the line drawings. Technically experienced men without formal engineering education can readily understand the book. It should also be useful to the engineer because it deals with such a practical subject. Anyone doing repair or maintenance work on dc machinery should find this book very useful.

Determining AC Machine Performance

Alternating-Current Machines—3rd Edition. By A. F. Puchstein, T. C. Lloyd and A. G. Conrad. Published by John Wiley & Sons, Inc., New York 16, N. Y. 721 pages, illustrated. Price $8.50.

Beginning with transformers the book shows how to understand, test, predict and calculate the behavior and performance of alternating-current machinery. The authors have described significant changes in the more detailed developments of equivalent circuits, vector diagrams, methods of calculating the cross-axis voltages of synchronous machines, and the equations describing the oscillations of synchronous motors. Some new material includes information on adjustable-speed drives, self-synchronous machines, and rectifiers.

How Systems Operate

Electric System Operation. Edited by B. G. A. Skrotzki with contributions by W. C. Astley, E. L. Michelson, E. R. Paige, and M. J. Steinberg. Published by McGraw-Hill Book Co, Inc, New York, N. Y. 370 pages, illustrated. Price $6.50.

Written for the reader without extensive engineering background who wishes to gain broad understanding of the utility industry, this book reviews the utility system from fuel input to customer's connection. It shows all the operations involved in scheduling and maintaining equipment to produce electric power economically and efficiently. Also included is information on relays, load dispatching and control, system communications, operating costs, and rate schedules.

Treatment is very elementary but clear and complete. Sections on load dispatching, station performance, economic loading, and system operating costs are exceptionally well written and may even be of interest to practicing engineers who do not normally deal with these subjects. It would be an excellent introduction to the utility industry for the recent engineering graduate. And supervisors could well recommend it to their technicians as a means of broadening their understanding of the industry.

VICTOR "Know-How..."

Gives You Purified Porcelain Suspensions...

America's Finest

VICTOR NO. 924
(EEI-NEMA TDJ-52-5)
25,000 LB. SUSPENSION
INSULATOR

VICTOR *Purified* Porcelain suspension insulators are laboratory designed to make them the finest in their field. VICTOR'S complete testing facilities, which include the industry's most modern impulse generator, certify to the soundness of their design.

Take the 25,000 lb. unit shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt, built to the most rigid specifications, are thick, husky and double-dip galvanized to withstand the severe service for which this insulator was designed. Scientifically fitted glaze, properly and uniformly applied, gives added strength . . . added protection against contamination. Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. You just can't buy a better suspension!

SPECIFICATIONS

60-cycle dry flashover	80 KV
60-cycle wet flashover	50 KV
Positive impulse flashover*	125 KV
Negative impulse flashover*	130 KV
Dry arcing distance	7¾"
Leakage distance	11"
M and E strength	25,000 lbs.
Impact rating	60 in. lbs.
RNI	50 Microvolts
1000 KC at applied	10 KV

*Crest KV, 1½ x 40 microsecond wave Critical Value.

NEWS FROM VICTOR

These two booklets—"The Story of Victor" and Bulletin No. 4—contain a wealth of insulator information that has proved of tremendous interest to thousands of power men throughout the nation. If you do not have both in your files, ready for instant reference, send for them today.

SPECIFY VICTOR Purified Porcelain Suspensions!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

More efficient connections all three ways...

BRAZED

CLAMP TYPE

BOLTED

Because it's SQUARE!

CHASE® VENTILATED SQUARE
COPPER TUBE BUS CONDUCTOR!

Power gets a green light, even through the joints of Chase square copper tube bus! Those four flat sides have more than enough surface area for brazed, bolted or clamped connections to take a tight, highly conductive grip. Such firm and secure joints have high mechanical strength, too—withstand the distorting forces of heavy short-circuit current almost as well as beam-rigid Chase square tube bus itself! Add the increased current-carrying capacity of *cooler-performing*, ventilated Chase square tube conductor, and you have electrical main arteries second to none in performance!

Write for *free* Chase Bus Conductor Brochure *today!*

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The Nation's Headquarters for Brass & Copper (*sales office only)

Albany*	Chicago	Detroit	Los Angeles	New Orleans	Rochester*
Atlanta	Cincinnati	Grand Rapids*	Louisville*	New York	St. Louis
Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
Boston	Dallas	Indianapolis	Minneapolis	Pittsburgh	Seattle
Charlotte*	Denver	Kansas City, Mo.	Newark	Providence	Waterbury

Low Foreign Bids Fought

. . . as Penn Transformer calls on senators for aid; $2-million contract for 21 63,000-kva transformers for Dalles Dam at stake

For the second time in seven months Pennsylvania Transformer Co, underbid by a foreign manufacturer, has called on Pennsylvania senators and officials for assistance in obtaining a government contract. The Canonsburg, Pa., firm was low domestic bidder in both cases.

The dispute involves bids for twenty-one 63,000-kva power transformers for the Dalles Dam in Oregon. Penn Transformer stated that its bid of $2,284,728.75 was underbid by $329,-169.25 by Brown-Boveri of Switzerland. These figures take into consideration a 6% "Buy American" differential added to all foreign bids, the U. S. firm noted.

Last week Penn Transformer sent letters to Sens Edward Martin and James Duff, Gov George M. Leader and Rep Thomas E. Morgan to request aid in securing the contract.

In a similar controversy Penn Transformer was awarded a $556,868 contract for Chief Joseph Dam equipment after months of deliberation (EW, Oct. 31, p 124). Secretary of Defense Charles Wilson rejected English Electric Co's low bid of $470,965 because of the Canonsburg area's unemployment. Senators Martin and Duff and other Pennsylvania officials had interceded for Penn Transformer in the dispute.

The manufacturer contends that, since the same unemployment conditions exist, it should receive the contract as low domestic bidder for the Dalles Dam's 21 transformers.

Department of Interior recently declared a policy on foreign bids (EW, Nov. 21, p 10). Under the new standard, foreign bidders will win contracts for heavy electrical equipment if their bids are 12% or more below the lowest bid by a U. S. firm, provided the latter plans to manufacture in a labor surplus area. If the area has no labor problems, the standard 6% differential applies.

Amarillo Has 2 Ft-C Street Lighting

New street light installation in Amarillo, Texas, is reported to be 20 times brighter than its predecessor. Average illumination reading is approximately 2.0 foot-candles.

This project has Line Material Co's new single-tank twin-lamp ballast top-mounted on 30.5-ft Carco steel light poles adapted for overhead wiring. Light standards are the anchor base type manufactured by Pacific Car and Foundry Co, are finished in aluminum paint, and are fitted with Type III Form 400 luminaires produced by General Electric Co. Each luminaire houses a 20,000-lumen E-H1 mercury vapor lamp.

The new street illumination is a result of an $80,000 investment by the Southwestern Public Service Co of Amarillo.

Cerro Buys Circle W&C, Elects Chief Officers

Cerro de Pasco Corp, New York mining firm with principal operations in Perù, recently acquired Circle Wire & Cable Corp for $20.25 million and incorporated the company in Delaware. Circle, formerly a New York corporation, manufactures insulated copper wire and cable at its Maspeth and Hicksville (Long Island) plants.

Robert P. Koenig, president of Cerro, was elected chairman of the new wholly owned Cerro subsidiary. Milton S. Cohn was elected Circle's president and chief executive officer.

Other new Circle officers are: I. J. Furst and Harry Goodman, vice presidents; George Jacobs, treasurer; George H. Cain, secretary; and Joseph F. McGowan, assistant secretary and assistant treasurer.

ETL Expands Facilities for Electronic Testing

Electrical Testing Laboratories, Inc., New York, has expanded its electronic testing facilities and services. Of particular significance is its ability to conduct tests and engineering investigations well into the microwave regions, stated a spokesman.

In addition to the newly equipped 5,000-sq ft electronic laboratory, ETL has 13 other laboratories where tests of virtually any nature can be performed on equipment submitted.

(*More M & M on page* 174)

another
hot spot for
Continental wire

Toast—but *not* toasted wire. It's in "hot spots" like these that Continental's insulated, heat-resistant wire serves long and faithfully. Manufacturers, dealers and customers alike can be sure of top quality product performance year after year where the wiring is Continental heat-resistant, moisture-resistant insulated wire. For standard applications or special tough wiring problems, your Continental wire and cable specialist can help you. Write today.

ADDRESS: Continental Sales, Box 363, Dept. CWS-2
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SWITCHBOARD and RHEOSTAT WIRE—TYPE AIA
600 VOLT SERVICE
Available Sizes: 18 to 4/0 AWG inclusive

Solid copper conductor, asbestos insulation, asbestos braid . . . heat, flame and moisture resistant. U.L. Approved. Ideal for wiring rheostats, switchboards, control panels, and ovens where oil, grease, corrosive vapors, moisture **and high temperatures** are present. Maximum operating temperature 257°F.

Continental
WIRE CORPORATION
WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

R&IE Disconnect Switch Ready for Con Edison Co

First single-pole assembly of disconnecting switches for a 138-kv isolated-phase bus structure has been completed by R&IE Division of I-T-E Circuit Breaker Co. The bus structure is part of the new construction at Consolidated Edison Co's East River Station.

Eight three-pole switches will be supplied by the R&IE Division, Greensburg, Pa. First switch is scheduled for delivery in December.

The bus and switches are rated 138 kv, with a current rating 1,200 amp continuous and 60,000 amp momentary. Above illustrated disconnect switch towers over R. H. Albright, R&IE designer.

U. S. Copper Production

U. S. primary copper production, according to the Copper Institute in New York, was 100,208 tons for October, an increase of almost 4,000 tons over September's production and more than 68,000 tons over the year's low production in July. Refined copper production amounted to 127,765 tons in October, down about 12,100 tons from September's amount but up about 76,600 tons from July. Deliveries to fabricators amounted to 133,946 tons for October, a decrease of almost 11,000 tons from September but an increase of about 73,800 tons over July's deliveries. Refined stocks at the end of October were reported

(*Continued on page* 176)

40 PAGES of helpful information

on Recovering Dusts, Fly Ash, Mists, Fumes and other Suspensions from Gases.

This booklet summarizes

the important points design and plant engineers should know about Cottrell Precipitators . . .

- Basic types of Cottrell equipment.
- Principal elements in a Cottrell unit.
- Data on Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, pocket electrodes, etc.).
- Typical ways of removing collected material.
- Various Shell Constructions (steel, concrete, brick, etc.).
- The effect of various factors on efficiency and performance.
- Data on CMP (Combination Multiclone-Precipitator) Units.

. . . and many other helpful facts on Cottrell design and operation.

Latest data from Western Precipitation on Cottrell Recovery Equipment

Do you have operations in your plant where gas-laden suspensions, wet or dry, are a problem? Such suspensions may be dropping on surrounding property, causing nuisance difficulties. Or perhaps important values are being lost in stack gases that can be profitably recovered. Whatever the nature of your recovery requirements, you will find this 40-page Cottrell booklet of great help. It contains up-to-date data on the latest advancements in the electrical precipitation field – prepared by the organization that pioneered the commercial application of Cottrell Electrical Precipitators almost a half century ago and has consistently led in new Cottrell developments.

A copy of this data-packed booklet will be sent free to engineers and other executives interested in recovery processes. Send your request to our nearest office.

For nearly 50 years Western Precipitation has carried on a continuous research and development program on Cottrell Electrical Precipitators, Multiclone Mechanical Collectors and other types of recovery equipment. We are not affiliated with any other company in the electrical precipitation field except our wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. We are equipped to serve you anywhere in the United States, Canada, and throughout the world!

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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

HIGH VOLTAGE *Protection*

FOR

Public Service Electric and Gas Company

WITH

BISHOP NO. 125 ELECTRICAL FILLER TAPE

Public Service Electric and Gas Company's new Academy Street sub-station provides electricity to meet Jersey City, New Jersey's increasing need for power.

Permanent high power installations such as this require high quality, long lasting equipment. That's why the 5 KV through-type cable terminals pictured are permanently moisture-sealed with the aid of Bishop's No.125 Electrical Filler Tape. No.125 is substantially thicker (⅛ inch) than standard tapes, and builds up quickly while fusing into a solid wall of high dielectric insulation in a matter of seconds. It is molded by hand to the desired contour, presenting a smooth taping surface for the final, protective outer tape.

Building up a moisture-proof, corrosion-resistant contour on this 5 KV line where it enters a "pothead" is accomplished with Bishop's No.125 Electrical Filler Tape.

No. 125 is one of the tapes made by Bishop especially for power distribution applications. We'd be happy to send you descriptive data on the entire line at your request.

BISHOP MANUFACTURING CORPORATION
6 CANFIELD ROAD
CEDAR GROVE (ESSEX CO.) N. J.

(*Continued from page* 174)

to be 49,738 tons. This is 3,889 tons short of September's amount and about 13,500 tons more than July, which was the low for the 10 months this year.

A-C Releases Details on Ridgeland Spindle Burst

Full details on the results of the investigation of the failure of a low-pressure turbine spindle at Ridgeland Station, Chicago, were released in a paper presented to the 1955 Annual Meeting of the American Society Mechanical Engineers. Presentation was made by H. D. Emmert, Assistant Chief Engineer, Steam Turbine Dept., Allis-Chalmers Mfg Co, Milwaukee, Wis. The ASME paper is made available by Allis-Chalmers as its publication O3B-8365. Requests should be directed to the company, attention Industrial Press, Milwaukee 1, Wis.

The 165,000-kw cross-compound turbine spindle failed Dec. 19, 1954 during a routine over-speed-trip test after 4 months of service at the Commonwealth Edison Co station.

Essentially, the studies show that the accident was caused by flaws present in the forging at the time of manufacture, but which were not identified as flaws with inspection techniques in normal use when the forging was made in 1952.

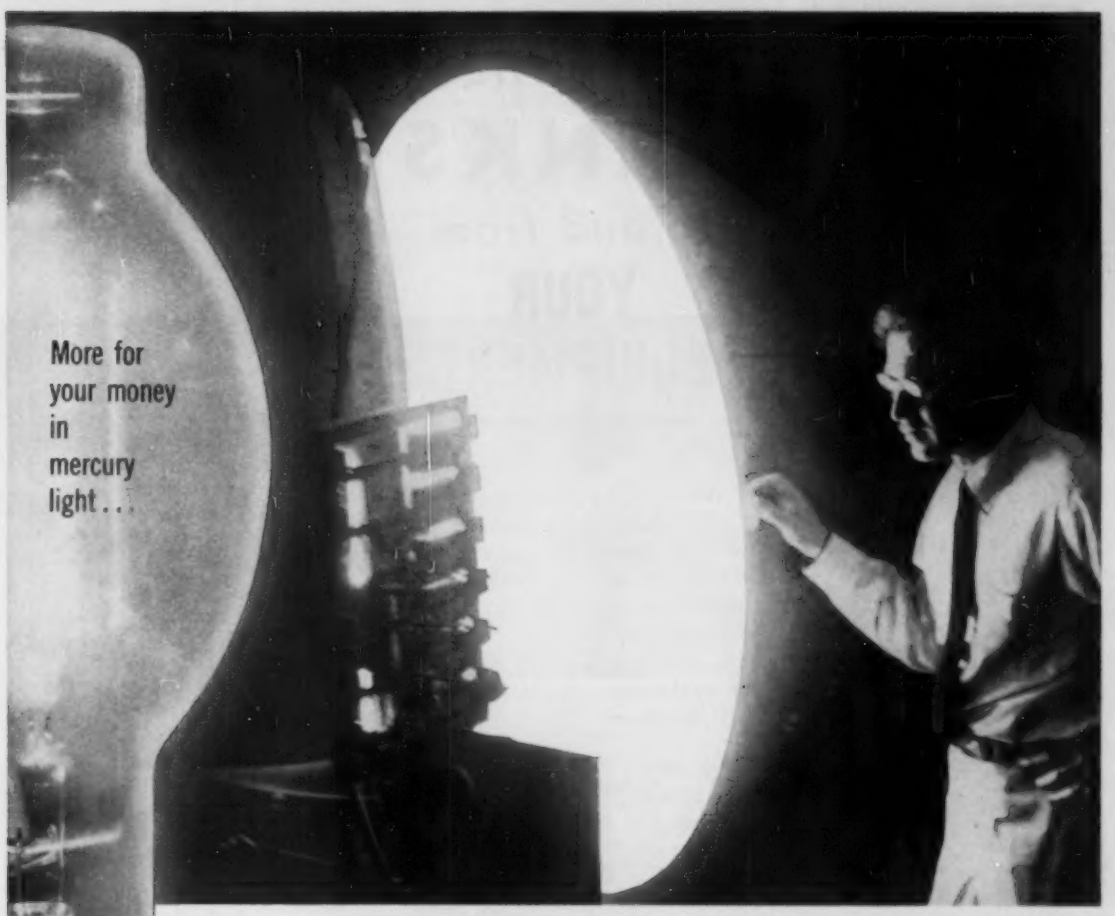
In commenting on the significance of the investigation to future turbine design, Emmert pointed out that there are three likely areas where improvement in the metallurgy of large forgings can take place: Improvement of the forging material, improvement in forging processing methods, and improvement in inspection techniques. "The latter holds the most immediate promise of results, we feel," said Emmert.

Westinghouse Forms Unit for Industrial Electronics

A department for the manufacture of a line of industrial electronics products was formed recently in Baltimore, Md., by Westinghouse Electric Corp.

A part of the company's Industrial

(*Continued on page* 178)



NEW, INCREASED LIGHT OUTPUT FOR 13 WESTINGHOUSE MERCURY LAMPS

Now—through advanced design and manufacturing techniques—the most widely used Westinghouse Mercury Lamps give you more light when *new*, more light *for life*.

Look at the following chart. It shows the new boost in initial light output for just two of the most widely used Westinghouse Mercury Lamps . . .

Lamp	Initial Lumens	
	Old Rating	New Rating
400-watt E-H1	20,000	21,000
400-watt J-H1	19,000	20,000

And there are similar high increases for *eleven* other popular Westinghouse Mercury Lamps.

But that's only half the story! For not only do these new, improved Westinghouse Mercury Lamps give increased light output to start with, they also *maintain* higher light output throughout their long life. For example . . .

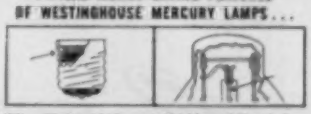
Lamp	Approximate Lumens at 4000 Hours	
	Old	New
400-watt E-H1	15,000	15,890
400-watt J-H1	14,000	14,700

These new Westinghouse Mercury Lamps are absolutely unequalled for *long useful life*. So today, even more than before, Westinghouse Mercury Lamps are by far your best buy for all high-intensity lighting.

This significant advance in Westinghouse Mercury Lamp performance is further evidence of Westinghouse leadership in mercury lighting—one more proof that Westinghouse Mercury Lamps give you "*more for your money in mercury light.*"

Westinghouse Guarantees the service life of all its widely used types of quartz mercury lamps. For full details call your Westinghouse Lamp Representative—or write Westinghouse Lamp Div., Dept. **EW-2**, Bloomfield, N. J.

TYPICAL MONEY-SAVING FEATURES OF WESTINGHOUSE MERCURY LAMPS . . .



Hi-Temp Life-Long-Tight Bases—non-deteriorating bonding material eliminates costly shutdowns of loose bases, cracked bulbs, breakage when lamps are removed from sockets.

Molybdenum Ribbon Seals—seal 300° thick—permit easy expansion and contraction of lead-in wires and bulb material. Result: longer lamp life, fewer early failures.

YOU CAN BE SURE...IF IT'S Westinghouse

Ask about new Westinghouse **WEATHER DUTY**(TM) *Mercury Lamps!*

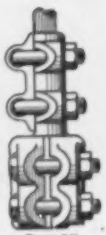
Be sure you have these ROYAL LINKS to and from YOUR EQUIPMENT

Generator Neutral Lead Terminal Assembly

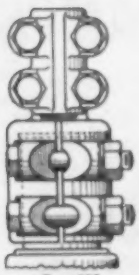
Type BXS
Catalog Page 19

Type BXL
Catalog Page 18

Type RS
Catalog Page 58



Type RU
Catalog Page 54



Type SBT
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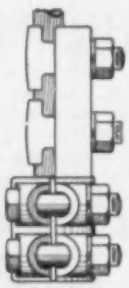


Type CDE
Catalog Page 55

★ Recognizing the importance of stud connectors and equipment terminals for dependable electric service, we prepared a comprehensive technical handbook last year. The response from utility engineers indicates the enthusiastic reception given this handbook.

Royal power connectors have been produced in a wide variety of types for many years. They are manufactured from high conductivity, high strength copper alloy. Multiplicity of point contacts develop the lowest resistance and highest pull-out strength. Nested bolt heads permit "one wrench" installation.

If you do not already have the "Handbook of Equipment Terminals" drop us a note for your free copy.

We would be pleased to have you also write for our catalog #12 which lists connectors and other Royal substation equipment.

Royal

A Part of the Account of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

(*Continued from page* 176)

Heating Division, the new department will be responsible for engineering, manufacture and sale of induction heating equipment, power line carrier equipment and other industrial electronic devices.

Robert C. Cheek was named manager of the Baltimore unit which will employ about 115 persons.

M&M Briefs

Hubbard & Co recently placed a five-year warranty "against failure resulting from defective material or workmanship" on its lightning arrester, the Autogap. The warranty provides that a new unit will be supplied without charge to replace a defective arrester.

Allis-Chalmers Manufacturing Co recently shipped a large power transformer to Puerto Rico Resources Authority for general use in San Juan. It is a three-phase 50,000/66,667-kva, OA/FA, high-voltage 38.0-kv Y, low-voltage 13.8-kv delta unit.

Chrysler Corp plans to push research on nuclear and solar energy, gas turbine engines, and electronics in the next five years as part of its $1-billion expansion program.

Bristol Engineering Corp doubled its working area with a recent long-term lease of a three-story factory in Bristol, Pa. The 33,000-sq ft building will house the company's Electronic Division and experimental and fabricating shops.

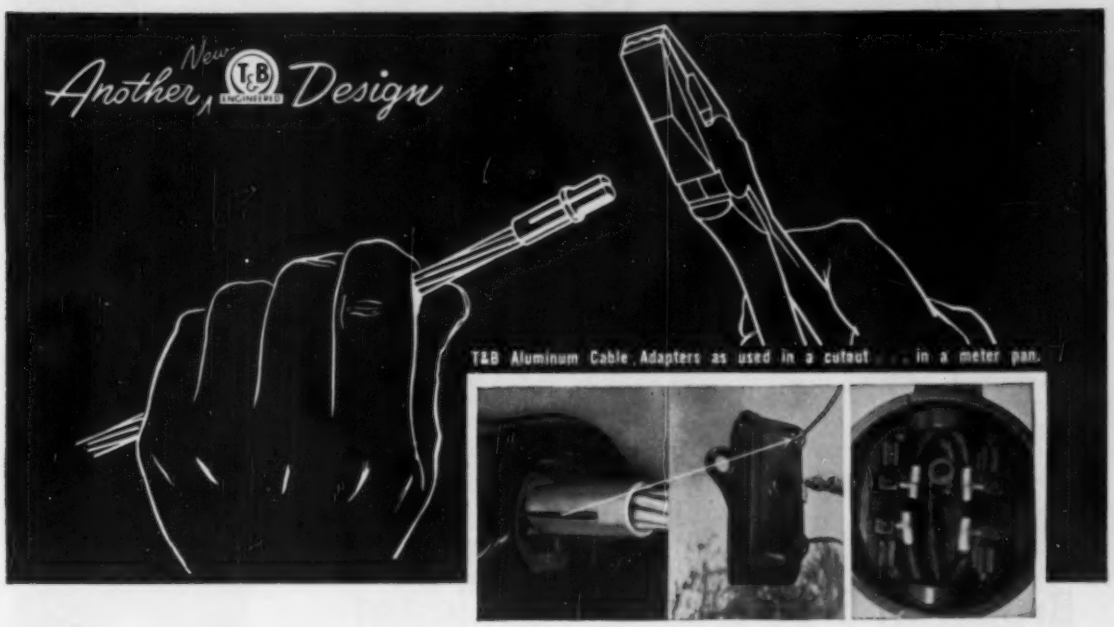
Joseph T. Ryerson & Son, Inc., national steel distributor, has purchased from Seaboard Air Line Railroad 11.5 acres of unimproved land at Pinoca, immediately northwest of city limits of Charlotte, N. C. Plans include construction of a new and larger steel service plant in the near future to replace the present plant in Charlotte.

Square D Co has formed an English subsidiary to manufacture and market its electrical distribution and control products in the British Isles and Europe. The company will be named Square D Ltd. It began operations on Nov. 1 from headquarters at 100 Aldersgate St, London.

IF YOU'RE WIRING WITH ALUMINUM . . .

Utility Engineers are now installing aluminum cable in many places where only copper had been suitable. Equipment such as transformers, capacitors, cutouts, switches, and meter pans, having terminals designed for copper conductors, are now being wired to aluminum and A.C.S.R. with little or no difficulty.

How? T&B's new Aluminum Cable Adapters. They're made of heavily-tinned copper alloy; take up little more space than the cable; install in a jiffy. A lineman or electrician merely taps one onto the end of the conductor, then clamps the adapter as though it were copper conductor. "Straight" and "flag" types are available. The flag type is best for connections at right angles to cable outlets.



One of the outstanding features of these new adapters is the serrated bore. As the adapter is tapped onto the cable, the serrations bite through the aluminum oxide coating. The high-conductivity connection thus formed is maintained, despite weather and moisture, by an oxide inhibitor precoated in the bore. The clamp end is slotted and spring-like to maintain pressure during thermal expansion and contraction.

These versatile Cable Adapters are opening up many new applications for aluminum cable. Sizes for cable up to #2 Str. at present. If you're wiring with aluminum, you might possibly have a unique application. If so, let us know about it. We'll be glad to send you a free sample of the adapter and descriptive literature. Write to The Thomas & Betts Co. today.

Note how the bore serrations have scraped through the oxide coating on the cable end.

LOOK FOR THIS SIGN — AUTHORIZED DISTRIBUTION T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-415

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

NEWS ABOUT PEOPLE

M. C. REED

W. B. STAFFORD

G. O. HYLANDER

H. W. BALGOOYEN

American & Foreign Power Promotes Officials

American & Foreign Power Co, Inc, has announced the election of four executive vice presidents—Myron C. Reed, William B. Stafford, Grant O. Hylander, and Henry W. Balgooyen. Elected as vice presidents were Donald G. Lewis and M. Claire Titus.

Reed, who will be in charge of operations, has had regional responsibility for properties in Colombia, Costa Rica, Ecuador, Guatemala, Panama, and Venezuela since 1952.

Stafford, named to head finance, has been financial vice president of the company for several years and a director since 1935.

Newly appointed administrative assistant to the president, Hylander has been vice president and a director since 1952. Before that he was vice president of the firm's service organization, Ebasco International Corp.

Balgooyen, vice president since 1952, will be in charge of commercial development and public and governmental relations. He formerly served as secretary and assistant treasurer of Foreign Power and Ebasco.

As vice president, Lewis will be responsible for system activities in Cuba and Mexico. Titus, who will head rate matters and personnel, comes to Foreign Power from Arizona Public Service Co where his resignation as vice president becomes effective Jan. 3, 1956.

Brockton Elects Eaton President

Louis F. Eaton, operating vice president of Brockton Edison Co, has been elected president of the utility as of Jan. 1, to succeed Walter A. Forbush, who will continue as a director and chairman of the board's executive committee.

Eaton, who joined Brockton in 1926, served as assistant to the vice president in Stone & Webster Service Corp's Boston office from 1939 to 1942. After two years with Blackstone Valley Gas & Electric Co, he joined Montaup Electric Co as assistant general manager. From 1946 until his 1953 appointment as Brockton's operating vice president, he was Blackstone division manager at Woonsocket.

Succeeding Eaton is Paul E. Milstead, chief engineer of Tampa Electric Co.

Sharp Named Southwestern VP

Southwestern Gas & Electric Co has elected S. M. Sharp vice president in charge of engineering. In his new position, he will also have charge of the general engineering, transportation, labor relations, Rural Electrification Administration contract relations and division superintendents departments.

Sharp, who has been on leave of absence doing special consultant work for the past eight months, is former vice president and chief engineer of the utility.

L. T. Williams, acting chief engineer, has been named chief electrical engineer and will direct the work of the general office engineering staff and have charge of substation and transmission planning and construction.

(More News About People on page 182)

Why freeze your dollars in communications equipment?

When the Bell System furnishes your communications, you profit from many important advantages.

1—Your money is not "frozen" in equipment, but is free to produce income.

2—You pay only a monthly charge for services tailored to your exact needs.

3—You avoid a large capital investment.

When you use Bell System communications, you eliminate all problems concerning maintenance and obsolescence. Also, you get the benefit of trained personnel, expert servicing and continuing analysis.

If you haven't taken a good look at your communications lately, why not let a Bell System communications engineer survey your needs without cost or obligation. Call your Bell Telephone representative.

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER MOBILE RADIO TELEMETERING AND REMOTE CONTROL CHANNELS

P. SPORN T. G. LE CLAIR

W. L. CISLER L. C. MORROW

Sporn, Cisler Honored at ASME Meeting

Two utility presidents were recently honored at the Diamond Jubilee annual meeting of American Society of Mechanical Engineers. They were Walker L. Cisler, president of Detroit Edison Co, and Philip Sporn, president of American Gas & Electric Co.

Cisler, 24th recipient of the Henry L. Gantt Gold Medal, was cited in the award certificate as "scientist, engineer, inventor, . . . developer of engineering devices and techniques, leader in industrial research, whose ideals and accomplishments have been inspirations to men of many countries." L. C. Morrow, chairman of the Gantt Medal board of award, made the presentation on behalf of American Management Association and ASME, sponsors.

Sporn was awarded the John Fritz medal, sponsored by American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Institute of Electrical Engineers, and ASME. Described in the award citation as a "distinguished engineer, pioneer in utility engineering practice, eminent executive, human administrator," Sporn is congratulated (above) by Titus G. Le Clair, chairman of the John Fritz board of award.

ASME meeting story will appear in EW, Dec. 19.

Jacobs Made Board Head

Arizona Public Service Co has elected John M. Jacobs chairman of the board.

A director of the utility since 1945, Jacobs has served as chairman of the board's operating committee. The board chairman post has been vacant since the death of M. O. Best earlier this year.

J. M. JACOBS

Weston Ups Steinkamp

Wilbert H. Steinkamp has been named vice president in charge of sales for Weston Electrical Instrument Corp, subsidiary of Daystrom, Inc.

He comes to Weston from Beckman Instruments, Inc, where he had served as vice president and general sales manager since 1952. Before that he was associated with Brown Instrument Co in various sales executive posts.

W. H. STEINKAMP

Personal Briefs

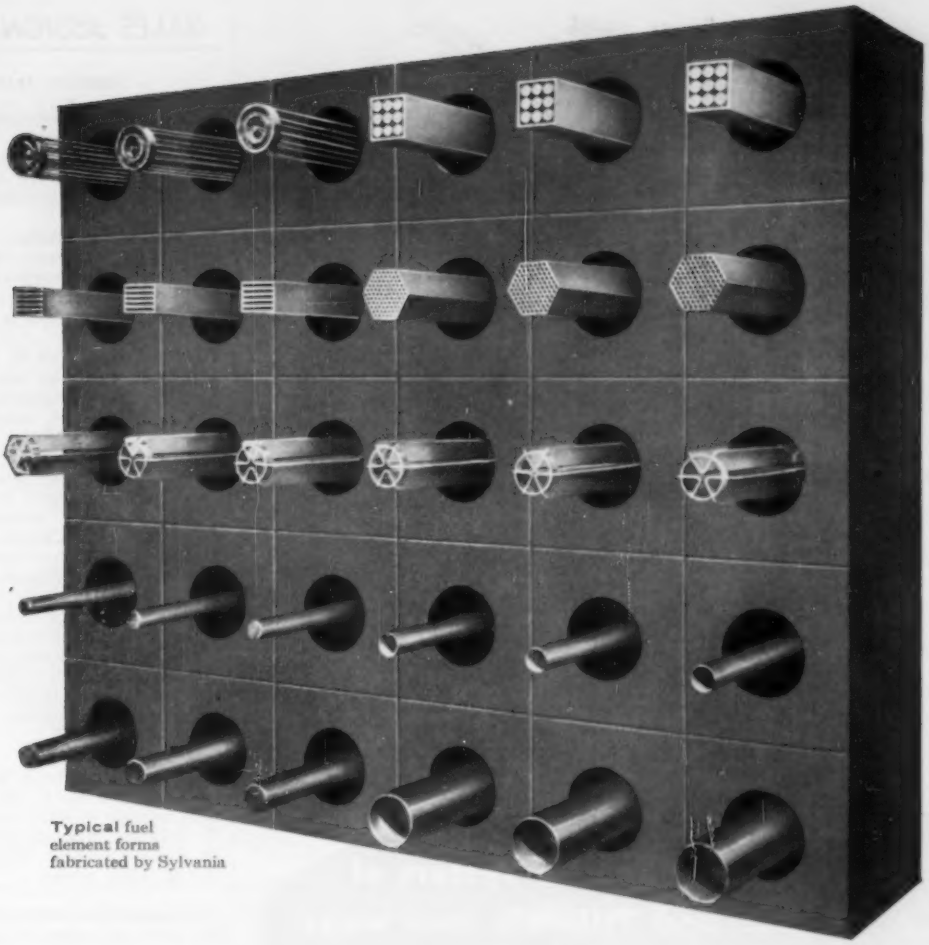
Potomac Edison Co has promoted **John W. Morgan,** operating manager for the company's Frederick district, to manager of the district. His appointment becomes effective Jan. 1, following the retirement of **Robert L. Smith,** who now holds that post.

Raymond S. Thatcher has been appointed a member of Connecticut Public Utilities Commission. A former state controller, he succeeds **Frederick H. Holbrook,** who resigned upon reaching retirement age.

Benjamin Electric Manufacturing Co has named **A. E. Swedenborg,** former assistant general sales manager, as general sales manager. He is succeeded by **Robert J. Mors.**

Westinghouse Electric Corp's **William L. Borden** has been designated assistant to the vice president, atomic power.

(*More Briefs on page* 190)



Typical fuel element forms fabricated by Sylvania

SHAPES OF THINGS TO COME

. . . in atomic power

The manufacture of nuclear fuel is one of the most critical aspects of the world-wide effort being devoted to the attainment of economic electric power from the atom.

Efficient utilization of nuclear fuel depends greatly upon the design and construction of the fuel element itself. Shape, size, degree of enrichment, mechanical structure all play a part in extracting maximum energy with minimum fuel cost. Finally, the *reprocessing* of used fuel elements requires expert knowledge and specialized equipment.

With more than eight years of successful experience in solving advanced technical problems in atomic energy . . . Sylvania has long been a leading fabricator of reactor fuel elements and assemblies. Sylvania's Atomic Energy Division is equipped to supply production quantities of standard fuel elements . . . or special designs to meet your particular requirements.

Whether your reactor plans are immediate, or for the future . . . our scientific and engineering staff will gladly discuss your problems with you. For your reference files, write for: *Sylvania Atomic Fuels and Reactor Components.*

Sylvania Electric Products Inc.
Atomic Energy Division, P. O. Box 59,
Dept. 2826, Bayside, New York

SYLVANIA®

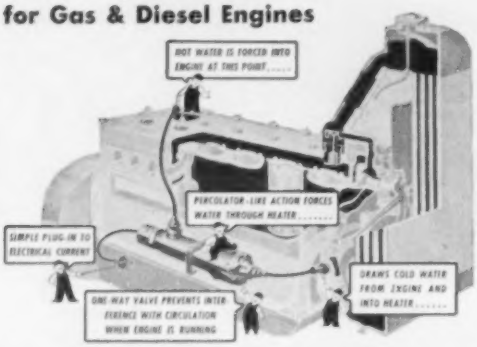
ATOMIC ENERGY DIVISION

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

Jack Rabbit Starts...with

KIM Hotstart

electric pre-heater for Gas & Diesel Engines


HOT WATER IS FORCED INTO ENGINE AT THIS POINT.....
PERCOLATOR-LIKE ACTION FORCES WATER THROUGH HEATER.....
SIMPLE PLUG-IN TO ELECTRICAL CURRENT
DRAWS COLD WATER FROM ENGINE AND INTO HEATER.....
ONE-WAY VALVE PREVENTS INTERFERENCE WITH CIRCULATION WHEN ENGINE IS RUNNING

8 Outstanding Features

- Gives quick, easy starts
- Reduces motor wear
- Prolongs battery life
- Four models — quickly installed
- Reduces fuel consumption
- Saves warm-up time
- Cuts costs of terminal heating
- For stationary or mobile engines — diesel or gas

Fast action now means dollars saved in your winter operating budget. KIM Hostart installations lick winter grief; end sluggish motors, end service tie-ups and high repair bills. KIM pre-heater means quick starts, efficient engine operation, lower cold weather operating costs all the way around.

See any leading auto supplier. Or write for literature.

KIM HOTSTART MANUFACTURING CO.
West 917 Broadway, Spokane 1, Washington

a new, superior system of
CABLE and TUBING race ways
GLOBE'S CABLE WAY
Easy to Install
Saves Time
Saves on Material
Galvanized
No Maintenance problem
A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.
Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.
Write for new complete catalog.
Distributors in all principal cities.
Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.
THE GLOBE COMPANY
Manufacturers Since 1914
4000 S. Princeton Ave.
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Globetray
THE GLOBE COMPANY
CHICAGO 9, ILLINOIS

SALES ASSIGNMENTS

COMPANY STAFFS

A. B. Chance Co has appointed Fred B. Woods assistant to the regional sales manager and regional specialist for the southeastern states. He is former district sales manager in Richmond, Va.

Electric Storage Battery Co has appointed E. J. Fitzmaurice, Jr, former manager of sales engineering of Exide Industrial Division, Boston branch sales manager. His successor is Evans Taylor.

General Electric Co's H. F. Phelps has been named district manager of the recently created component and intermediate distribution sales department, Apparatus Sales Division. As head of the Michigan District with headquarters in Detroit, Phelps has appointed the following representatives: H. O. Mellem, manager-equipment industries sales for Detroit, Jackson, Lansing, and Saginaw areas; D. D. Barlow, manager-specialty sales for Detroit, Jackson, and Lansing areas; D. E. Hathaway, manager-distributor-contractor sales, all Michigan areas; F. J. FitzGerald, manager-specialty sales for Grand Rapids, Kalamazoo, and Battle Creek areas; and J. H. Houtsma, manager-equipment industries sales for Grand Rapids, Kalamazoo, and Battle Creek areas.

General Motors' Electro-Motive Division has promoted R. J. Hondlik, branch sales manager at Robertson, Mo., and J. E. O'Leary, regional service manager, St. Louis, to district sales managers in the St. Louis region.

Minneapolis-Honeywell Regulator Co has appointed Raymond A. Zack industrial sales manager of its Hammond, Ind. branch office.

Joseph T. Ryerson & Son, Inc, has named Napier B. Caldwell, manager of tubular products and cold finished steel bar sales, sales manager for the Boston Plant. Joseph A. Moran, formerly a sales representative, replaces him.

Sylvania Electric Products, Inc, has designated Charles A. Dickinson special representative, national accounts, lighting, for the western region including California, Oregon, Washington, Nevada, Idaho, Montana, Utah and Arizona.

Westinghouse Electric Corp has appointed Carlyle W. Miller area sales manager, Apparatus Division with headquarters in San Francisco. Miller, former sales manager of Industrial Electronics Division, Baltimore, Md., succeeds G. B. Mason who has been transferred to the company's Los Angeles office.

Wiremold Co's Wallace P. Ernsberger has been named sales engineer for the St. Louis area and assistant to Victor A. Meier, district sales manager at Kansas City.

Will this blot spread . . . or shrink?

NOTHING STRIKES so brutally at human lives as a slum.

Yet of America's many millions of homes, the blot that is a slum covers more than 1 out of every 10 . . . and nearly one-half of all our homes are urgently in need of repair and basic improvements.

Will the blot go on spreading? Or will a concerted, nationwide attack on the causes of slums shrink it, year by year, until it is wiped out? Today, this is a challenge to every American . . . a challenge that *must* be met.

Your community . . . your problem!

A slum reaches across blocks, across miles, to sit on your doorstep and demand a price.

You pay it in the threat of crime and juvenile delinquency to your family. You pay the price in higher personal property taxes to fight the disease and crime and poverty that are slum-bred. You pay personally when the value of your home sinks as community deterioration takes another step closer.

Your *firm* pays when the community where you do business goes downhill. Slums automatically mean lower purchasing power and less effective labor.

Good citizenship is good business

It's good citizenship and good business both for your firm to join efforts to check housing decay . . . to stop slums before they start. In fact, it's the *responsibility* of every business, as it is of every other good citizen, to support community improvement efforts.

Some slums are beyond repair. They should be torn down and a fresh start made. Others can be remodeled, made to conform to better living standards. So it is up to you to get behind every sound program which seeks to provide adequate housing for all our people.

Adding your support to the efforts of the millions already attacking the problem, your firm can help stop slums cold and put America's housing standards at a new height.

How to get into action

A group of Americans from every walk of life has formed a new, non-profit organization to help combat home and community deterioration – The American Council To Improve Our Neighborhoods . . . A.C.T.I.O.N.

Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It also lists booklets, research reports, check-lists, and other material which can help you protect the housing health of your community. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American **C**ouncil **T**o **I**mprove **O**ur **N**eighborhoods

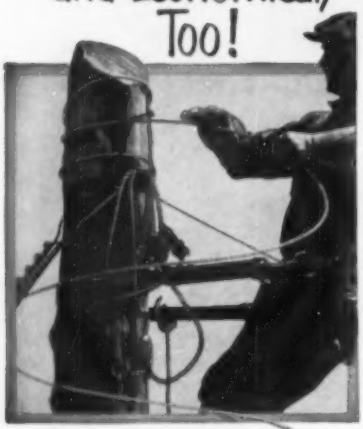
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

and Economical, Too!



● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

DECEMBER

ENGINEERS JOINT COUNCIL—Nuclear Engineering & Science Congress, Public Auditorium, Cleveland, Ohio, Dec. 12-16.

ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM—Steering Committee, Biltmore Hotel, New York, Dec. 13.

EDISON ELECTRIC INSTITUTE—Industrial Relations Committee, EEI Headquarters, New York, Dec. 15.

JANUARY 1956

WEED SOCIETY OF AMERICA—Charter Meeting, Hotel New Yorker, New York, Jan. 4-5; Northeastern Weed Control Conference, Annual Meeting, Hotel New Yorker, New York, Jan. 6.

*** PERSONNEL TESTING LABORATORY**—14th Personnel Testing Institute, Rensselaer Polytechnic Institute, Troy, N. Y., Jan. 16-20.

EDISON ELECTRIC INSTITUTE—Financing & Investor Relations Committee, Hotel Biltmore, New York, Jan. 19; Industrial Relations Committee, EEI Headquarters, New York, Jan. 19; Prime Movers Committee, Warwick Hotel, Philadelphia, Pa., Jan. 30-Feb. 1

OKLAHOMA UTILITIES ASSOCIATION—Accounting Section, Alvin Hotel, Tulsa, Okla., Jan. 20.

AMERICAN SOCIETY HEATING & AIR CONDITIONING ENGINEERS—Annual Meeting, Cincinnati, Ohio, Jan. 23-25.

NATIONAL RURAL ELECTRIC COOPERATIVE—14th Annual Meeting, St. Louis, Mo., Jan. 23-26.

DOBLE ENGINEERING CO.—23rd Annual Conference of Doble Clients, Sheraton Plaza Hotel, Boston, Mass., Jan. 23-27.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Fairmount Hotel, San Francisco, Calif., Jan. 24-27.

*** ELECTRICAL EQUIPMENT REPRESENTATIVES ASSOCIATION**—Annual Meeting, The Edgewater Beach Hotel, Chicago, Ill., Jan. 26-28.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter General Meeting, Hotel Statler, New York, Jan. 30-Feb. 3.

FEBRUARY

*** GREAT LAKES POWER CLUB**—LaSalle Hotel, Chicago, Ill., Feb. 2-3.

EDISON ELECTRIC INSTITUTE—Conference Planning sponsored jointly with AGA, William Penn Hotel, Pittsburgh, Pa., Feb. 2-3; Transmission & Distribution Committee, Warwick Hotel, Philadelphia, Pa., Feb. 7-8; Electrical Equipment Committee, Homestead, Hot Springs, Va., Feb. 13-14; Commercial Lighting Committee, Hotel Shoreham, Washington, D. C., Feb. 15-16; Meter & Service Committee, Hotel Cleveland Cleveland, Ohio, Feb. 20-22.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 2-3.

INDUSTRIAL ELECTRIFICATION COUNCIL—National Industrial Electric Heating Conference, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 6-10.

PENNSYLVANIA ELECTRIC ASSOCIATION—Relay Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 9-10; Electrical Engineering Committee, Penn Harris Hotel, Harrisburg, Pa., Feb. 9-10; Systems Operation Committee, Hotel Statler, New York, Feb. 16-17.

SOUTHEASTERN ELECTRIC EXCHANGE—Personnel Administration Section, Buena Vista Hotel, Biloxi, Miss., Feb. 9-10.

ROCHESTER ELECTRICAL EXPOSITION—War Memorial Building, Rochester, N. Y., Feb. 18-25.

NATIONAL ADEQUATE WIRING BUREAU—12th Annual Conference, LaSalle Hotel, Chicago, Ill., Feb. 23-24.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, N. Y., Feb. 27-March 2.

MARCH

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Spring Meeting, Multonomah Hotel, Portland, Ore., March 18-21.

ILLINOIS INSTITUTE OF TECHNOLOGY—18th Annual American Power Conference, Hotel Sherman, Chicago, Ill., March 21-23.

OKLAHOMA UTILITIES ASSOCIATION—Annual Convention Biltmore Hotel, Oklahoma City, Okla., March 22-23.

PACIFIC COAST ELECTRICAL ASSOCIATION—Engineering & Operating Section, Palace Sheraton, San Francisco, Calif., March 22-23.

* Additions this week.

VEPCO Addition Okayed

Addition of a $22-million, 150,000-kw generating unit at Virginia Electric & Power Co's power station at Bremo Bluff on the James River has been authorized by the company's board of directors. Scheduled for completion by May, 1958, the Bremo addition will be the same size as the first unit at VEPCO's new station now being constructed at Yorktown.

At less cost than a dozen miles of new high-line,

any electric utility company can place a 1,000 KW. Electro-Mobile Power unit right at the point of need.

It postpones investment in additional generating station capacity.

Transmission line loss is eliminated.

Complete self-operation can be provided.

The unit may be moved to any other site quickly and cheaply.

Write for simple formula explaining investment advantages of Electro-Mobile Power:

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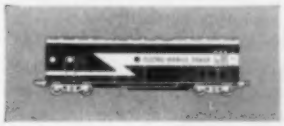

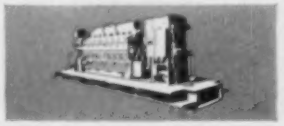

Rail car, truck trailer and portable units—350 to 1,000 KW.

Sold and serviced directly through a manufacturer's organization. Electro-Motive Division offices located in: New York City, Chicago, Jacksonville, St. Louis and San Francisco. *In Canada:* GENERAL MOTORS DIESEL, LTD., London, Ontario

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• Security against the ever-present hazards that can damage or destroy property, or injure persons, is a responsibility to assign to PAGE Fence. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

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ORIGINATORS OF THE BENDING HINGE ANCHOR

P-L

Bad Splices Detected

(*Continued from page* 99)

amp, load dispatcher is requested to arrange the system so that line to be checked will carry 400 amp.

A form has been developed for recording of data. In addition to spaces for recording data for each splice, there are spaces for recording ambient temperature, weather, wind velocity, and load. This is to give some data for comparison of readings in case a splice is rechecked at some later date. Data recorded for each joint are gain position of amplifier, microampere reading, and temperature rise above ambient.

Bad Splices Broke Down

Examination of defective splices removed after check with bolometer shows that in some cases no compound was used inside of the splice. One splice not only had no compound in it and the conductors not cleaned, but also it was insufficiently compressed as well; the result was that steel strands were rusted to a point where tension finally caused them to part. In another failure the steel strands had become so annealed because of heat generated by poor contact that they broke under tension. Laboratory examination indicated that the steel at some time must have reached a temperature of about 1000F. Aluminum strands within the splice even showed a slight melting, indicating that a temperature in the neighborhood of 1,200F had been reached.

Poor Work on Repair Jobs

It is significant that all splices found defective were made after the original line installation. Some were made in connection with conductor repairs, others when line changes were made. In other words, all were made on corroded wire. In all instances the conductors had not been cleaned prior to making the splices. Conversely, the splices made on new clean wire at the time of the original installation (in many cases 25 to 30 years ago) are still operating perfectly.

It is obvious that the necessity for thoroughly cleaning, properly greasing, and properly compressing splices is not apparent to the linemen.

In addition to checking conductor splices and connections, bolometer can be used to check disconnect contacts for overheating.

Better Servicing Needed

(*Continued from page* 146)

FHA, building contractor, utility, manufacturer, and electrical contractor views coincided on this approach to the wiring problem. Similar unanimity was evident in regard to commercial and industrial wiring and power utilization.

Robert D. Golly, Rome Cable Corp; Emerson S. Reichard, General Petroleum Corp; and Michael Everz, McCullough Motor Co, cited both theory and experience to show that modernization of plant electrical systems more than paid for itself in improved productivity, reduction of accidents and rejects, and plant operation morale. Importance of the switch to electronic controls in industry was emphasized by Walter L. Sticket, Hoffman Radio Division, Hoffman Electronics Corp.

The agricultural electrification group reviewed methods by which the industry can assist farmers through automation of many farm operations. Cooling of chickens and rabbits during periods of excessive heat could be provided automatically. Push-button control of feed mixing and distribution through hoppers was presented as a method for uniform and better cattle feeding. Overhead sprinkling, said Frank Miramontes, Pacific Gas & Electric Co, conserves water and permits farming of rough or hilly land. T. L. Jones, Southern California Edison Co, described an automatic sprinkling system which moves hydraulically to cover an entire field.

S & S SHORTS

CG&E Wiring Hits $501,000

Cincinnati Gas & Electric Co's "Wire on Time" plan as of November 12, 1955 has financed 1,955 jobs for a total of $501,000. Sampling of customers who financed wiring modernization showed an average annual increase of 770 kwhr. The program began in October, 1953.

Home Lighting Fixture Sales Up

Sales of residential lighting fixtures in 1955 are estimated by American Home Lighting Institute, Inc, to hit $70 million. 1956 sales are expected to rise 15% and a 50% jump is foreseen in the next 10 years.

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LUMATROL®

Omni-Directional Photoelectric Light Switch integrates light from all directions . . . completely reliable in any weather, 12 months of the year!

LUMATROL offers *fully* automatic light control that is simple, reliable, compact and easy to install. LUMATROL can be used with, or easily adapted to, virtually *any outdoor lighting requirement*, regardless of location, type of pole or luminaire!

Although considerably lower in cost, LUMATROL rates *FIRST* on all twelve specifications applied to this type control. Only ruggedized components are used. ACCURATE, POSITIVE SWITCHING OF ILLUMINATION IS ASSURED UNDER ALL CONDITIONS OF USE. Wherever specified, Lumatrol is producing marked economies in maintenance and service costs.

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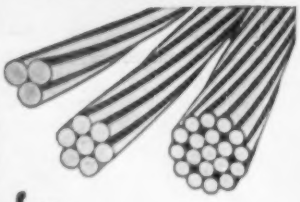

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PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value

PERSONAL BRIEFS

(*Continued from page* 182)

Wallace O. Lee will retire as senior vice president of Indianapolis Power & Light Co, but will continue, after next April, as a consultant on public relations for the firm.

John T. Kimball, vice president of Niagara Mohawk Power Corp, has retired from that office, but will be retained as a consulting engineer. He has also served, since 1944, as the system's chief rate engineer, and was formerly vice president and director of two other system subsidiary companies.

Virginia Electric & Power Co has named **A. H. McDowell, Jr,** division manager of the central district with headquarters in Richmond, effective Dec. 1. **W. J. Matthews,** manager of the southside district, succeeds McDowell as Richmond district manager Jan. 1.

Boston Edison Co has announced the retirement of **John T. Ward,** vice president of engineering since 1942.

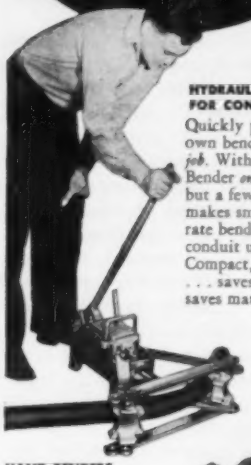
Miss Betty McHattan has been designated supervisor of Central Illinois Light Co's newly re-organized home service department.

Henry T. Mudd, president and director of Cyprus Mines Corp has been elected a director of Southern California Edison Co.

O. E. Asplundh and **W. West Jordan,** regional vice presidents and directors of Asplundh Tree Expert Co, have retired from active duty because of ill health but will continue to serve on the board of directors. One of the firm's founders, Asplundh had charge of midwestern and southwestern operations. Jordan, who served Ohio, Indiana, and Michigan, is succeeded by his son, **Dudley Jordan,** in the central eastern area. **Robert Gilbert** has been named regional manager in Texas, New Mexico, Oklahoma, and Arkansas; and **Earl Reynolds** has been promoted to regional manager for Illinois, Wisconsin, Minnesota, Iowa, and Missouri.

United Gas Improvement Co has appointed **Frank R. Palmer,** president of Carpenter Steel Co, a director to fill a vacancy.

CUT COSTS WITH GREENLEE TIMESAVING TOOLS FOR ELECTRICIANS



HYDRAULIC BENDERS FOR CONDUIT, PIPE
Quickly produce your own bends *right on the job*. With a GREENLEE Bender *one man* in but a few minutes makes smooth, accurate bends in pipe and conduit up to 5". Compact, portable . . . saves hours, saves materials.

HAND BENDERS FOR TUBING, PIPE, CONDUIT
Quickly form small-radius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

KNOCKOUT PUNCHES AND CUTTERS
For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½" up to 3½". To operate, simply turn with a wrench.

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Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs . . . easily operated. Develops over 11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.

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GREENLEE

Write for new Electrical Tool Folder, Greenlee Tool Co., 1812 Columbia Ave., Rockford, Ill.

Big Party for Small Plant Staged by Indiana Utility

More than 7,000 visitors recently turned out on the weekend to take a look at Southern Indiana Gas & Electric Co's new 40,000-kw Culley Plant located above Evansville on the Ohio River—20 miles from the nearest metropolitan center.

Some of the guests at the utility's open house are shown touring the turbine room above.

Peak attendance for the weekend occasion was recorded on Sunday when a line three deep stretched for more than a block at the plant entrance. Company officials reported that a pre-arranged tour route enabled them to move the crowd easily without delay.

Souvenir booklets were distributed to the visitors, and major features of plant equipment and operations were described with signs, charts, and pictures posted throughout the plant.

California Hydro Plant

Permission has been granted Southern California Edison Co by California Public Utilities Commission to build a 2.8-million, 10,000-kw hydro power plant at Huntington Lake, Fresno County. Planned completion date is November, 1956.

fustest with the mostest...

. . . gains many a victory — for manufacturers as well as for the military. In photoelectric lighting controls, for example, Fisher-Pierce was among the first (1945-6) to give street lighting engineers a sound, *dependable* group of controls.

But being among the "fustest," (or "pioneering," as ad men say), isn't in *itself* so wonderful. What it *does* mean is that every Fisher-Pierce control today represents nearly ten solid years of design improvement and millions of hours of actual use. And *that*, to the person who pays the bill, *is* important. Fisher-Pierce will be glad to furnish complete information and technical data.

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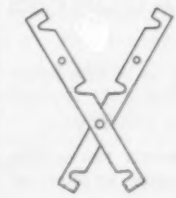
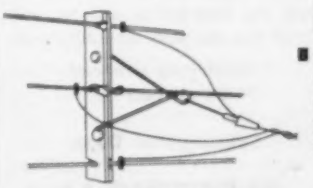
Secondary Conductor Spreader

■ SAVES UP TO 60% IN MATERIALS AND LABOR!





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- **for new line construction** — permits use of bare conductor; eliminates stripping at taps, splices, dead-ends; allows standard 8" spacing.
- **for service drop installation**—tap for service at any point, with mid-span load equally distributed; uses few poles, less drop wire.
- **for maintaining frayed circuits**—virtually prevents contact of weathered conductor and consequent arc-ing, proven through three years experience and 2 hurricanes.

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Accident Prevention

EEI committee meets, considers countershock current treatment and rescue practice

Ventricular fibrillation can be stopped through external application of countershock and without opening the chest, Dr W. B. Kouwenhoven, Johns Hopkins University, told the 60th meeting of the EEI Accident Prevention Committee at Beaumont, Texas.

Rescue Procedure Needed

Chance for successful recovery depends upon how soon countershock current can be applied after the onset of fibrillation. Thus there remains the problem of maintaining the victim's circulation until the defibrillating apparatus can be brought to the scene.

To complete the rescue procedure, a method of manual artificial respiration must be found which not only ventilates the lungs but also provides sufficient blood circulation to maintain the brain and heart in good condition. Recent new procedures tried in the laboratory were discussed by Kouwenhoven who said that 50 tests show the hazard of applying a fibrillating current to a normal human heart is slight.

F. G. Harriman, New England Power Service Co, reported an encouraging trend in accident rates for the first nine months of 1955 as compared with the same period in 1954. He "predicted" the 1955 frequency rate would be 7.24, 16% better than 1954; the severity rate of 1,375, a 9.5% improvement; the 243 performance index, 1.6% better; and 12.4% fewer deaths.

Hazards from Lines, Antennas

Hazards to the public arising from contact between overhead lines and television antennas, kites, model airplanes, and crane booms were discussed by J. Y. Andrews, Niagara Mohawk Power Corp. Florida Power Corp and Georgia Power & Light Co have issued a booklet, "Model Television Ordinance," which discusses the television antenna hazard and includes a model ordinance, Andrews reported. He said that a survey of the hazard and a study of preventive action will benefit all companies, particularly those which may find television reception dropped in their service area.

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make 'em like new

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Surges Predictable

. . . say geologists who claim giant storm waves in oceans, lakes can be foreseen; study to prove theory is launched

Freak storm surges on oceans and great lakes which in the past have struck without warning and caused extensive damage to coastal installations can be predicted several hours in advance.

This contention has been made by three geologists at Columbia University's Lamont Geological Observatory at Palisades, N. Y. And they have launched a three-year surges study project to prove it.

Study Will Focus on Past Surges

The three scientists are Dr Maurice Ewing, director of the Observatory, Dr Frank Press, and Dr William L. Donn. Their investigation is sponsored by the American Institute of Mining and Metallurgical Engineers and is being instituted by an Engineering Foundation grant.

The initial stages of the study will concentrate on two past storm surges. One is the Lake Michigan surge in June, 1954, which hurled an 8-ft wall of water against the Chicago lakefront. And the other is the Atlantic flood of Nov. 6 and 7, 1953, when tremendous damage was done along the Long Island, Staten Island, and New Jersey coasts.

Air-to-Coupling Theory Pushed

Dr Ewing and his colleagues believe that when a line squall with its accompanying area of high pressure travels over water at the same velocity as a wave, a resonant effect is produced which can push the wave to disastrous magnitude.

The Lake Michigan surge, the scientists state, appears to have been an example of this combination of atmospheric disturbance and natural wave period. When the wave struck the Chicago area, the weather was clear. But two hours earlier a severe squall with winds up to 66 mph had lashed the city.

After passing over the city, the squall and accompanying pressure-jump traveled 40 mi across Lake Michigan, arriving at Michigan City, Ind., simultaneously with a wave from the northwest. Eighty minutes later

(*Continued on page* 195)

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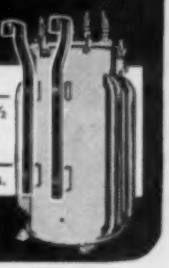
MODEL	C-1	C-3
TRANSFORMER	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
WEIGHT	46 lbs.	100 lbs.



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T-TYPE HANGERS in two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS in sizes to fit T-type hangers.

THIEL TOOL AND ENGINEERING CO. INC.

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The need for blood is greater than ever, not only for men wounded in combat, but here at home . . . to cure disease, to meet accidents and disasters, and to prepare for civil defense.

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You CAN give more than once . . . as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give goes to someone who needs it desperately.

Remember . . . once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

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...give it again and again

BUSINESS EXECUTIVES!

CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ○ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
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- ○ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ○ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ○ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ○ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ○ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ○ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ○ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . . the need for blood is **urgent!**

NATIONAL BLOOD PROGRAM

Surges Predictable

(*Continued from page* 193)

the reflected 8-ft wave washed back on the Chicago lakefront.

Although this theory is not a new one, the recently instigated study represents the first attempt to formulate a scientific explanation of Lake Michigan's great surge and to prove the air-to-water coupling idea.

The program ahead will necessitate continuous monitoring of atmospheric disturbances believed to be involved in the freak surges. This will be aided by a new type of instrument, the Wallace Microbarograph, which is sensitive enough to record disturbances that might generate small as well as large surges.

To study water-level records, Dr Ewing and his scientists are constructing their own recording device for installation at a lake station where it will be operated by the U. S. Lake Survey.

After completing studies on the Great Lakes, the geologists will focus their research on the coastal oceanic type of flood. If their theory is borne out, several hours' warning should be possible for freak storm surges in the future, the scientists believe.

Long-term Pacts Studied by BPA for Interruptible

Bonneville Power Administration is considering long-term contracts to supply Pacific Northwest electroprocess industries with 700,000 kw of interruptible power. Byron Price, assistant BPA administrator, told industrial customers of the tentative plans at their annual meeting in Seattle recently.

Proposed by industry, the contracts would assure maximum stability of operations for aluminum companies and other plants which depend on interruptible power for a substantial part of their operations.

SDG&E Seeks Plant Site

San Diego Gas & Electric Co has taken steps to purchase a 144-acre tract for a new steam electric generating station on San Diego Bay.

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1. Built-in power hoist and sheave have a capacity of 1500 lbs.
2. High speed auger digs holes up to 20" in diameter and depths of 10 feet.
3. Completely self-contained unit with no extra accessories to buy.
4. Finger-tip hydraulic controls for easy, one man operation.
5. Speedy operation saves time and money.

For complete details, write for bulletin **40EW.**

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SUPERIOR SWITCHBOARD & DEVICES CO.
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DESIGNED FOR OUTDOOR as well as indoor use, the CF-7 recorder withstands extreme heat (100 C) and cold (−40 C). A rubber gasket around the hinged cover completely seals the recorder case—helping to prevent rainwater and dirt from damaging the instrument or impeding its performance. The CF-7 will operate at 1 inch per hour for as long as thirty days, without attendance.

Accurate G-E Hook-on Recorder Can Help Analyze Coming Electrical Load Problems

G-E Instrument measures without interrupting service, gives clear, convenient records with a minimum of maintenance

General Electric's CF-7 portable hook-on recorder is a convenient, multi-range means of recording varying loads up to 750 amps—without interrupting service or wasting production time. You can use this versatile instrument to help solve coming load problems with such typical applications as:

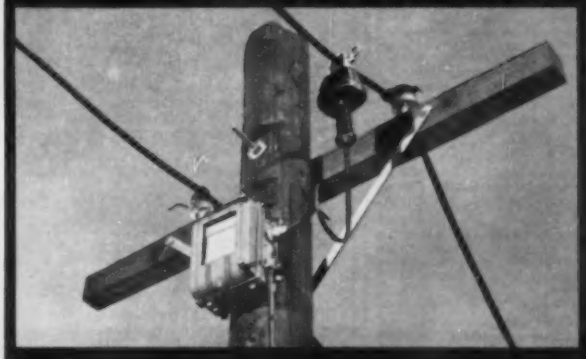
- Determining the sub-division of loads in distribution networks.
- Checking air-conditioning circuit operations.
- Checking loads on boiler feed pumps, electric heating installations and powerhouse machinery.
- Analyzing the characteristics of growing industrial and commercial loads.
- Checking for under- or over-loading of transformers.

INSTALLATION of the CF-7 recorder requires little more time than it takes for any hook-on instrument. Simply mount recorder, connect to 120 V or 240 V power supply, select range, attach leads, and hook on the line.

FOR FURTHER INFORMATION contact your nearest Apparatus Sales Office or clip and send the coupon.

G-E HOOK-ON volt-ammeter gives you accurate records over a wide range. Seven ranges provide a maximum number of applications at a minimum of instrument investment (15/75/150/750 amperes; 150/300/750 volts). An external range switch simplifies range changing.

G-E RECORDER CARRIES ASA INSULATION RATING OF 8700 VOLTS



SECTION B582-3
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, NEW YORK

Please send me a copy of the bulletin(s) checked below:

☐ GEA-5469 Buyer's Guide for Testing Instruments
☐ GEA-6104 CF-7 Hook-on Recorder

Name _____

Company _____

Street _____

City _____ Zone ____ State _____

SAFE AND ACCURATE: Butyl molding makes possible a transformer insulation rating of 8.7 kv. Even high-voltage circuits may be tested. Calibrated accuracy is ±3% of full scale (4% above 625 amperes). Installation is quick and simple.

FOR DETAILS on how G-E hook-on instruments can save you time by simplifying measurement, contact your Apparatus Sales Representative or clip and mail coupon for free bulletins.

GENERAL ELECTRIC

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

RATES

DISPLAYED

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

UNDISPLAYED

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for December 26th issue closing December 14th

POWER PLANT PERSONNEL

A middle east coast utility now constructing a new high pressure, pulverized fuel generating station will accept applications for employment from qualified persons for the following positions, which are available immediately:

Results or Test Engineer

Must be graduate mechanical engineer or equivalent, with experience in modern power plant operation and three years in a responsible supervisory results position. Will be required to assume full charge of power plant testing, chemical control, accounting and research.

Assistant Results or Test Engineer

Graduate mechanical engineer or equivalent, with experience in power plant test and technical work. Will conduct tests and research and maintain records under direction of the Results Engineer.

Job is located near excellent residential community, good working conditions, forty hour week (paid vacations, insurance, sick pay and retirement plan).

High caliber men are needed to fill the foregoing jobs, and for applicants meeting the above requirements, consideration will be given to reimbursement of expenses incurred for moving of household goods and personal effects.

Personnel selected will receive training at full pay in order to familiarize themselves with the plant before assuming their duties. Include a complete resume of experience and qualifications in first letter. All applications will be treated confidentially.

P-8298, Electrical World
330 W. 42 St., New York 36, N. Y.

RESEARCH ENGINEER

Graduate Electrical Engineer for work on electrical conductors. Will study, by measurement, such electrical characteristics as electrical conductivity, d-c and 60 cps a-c resistance, reactance, current rating, overload characteristics and check test results against theory. Familiarity with this specialized field desirable but not necessary. Required is a predilection for accurate experimental work, and a sufficiently broad physical and mathematical knowledge to analyze and interpret the results and to present them clearly in a well organized manner. Please reply to:

Dr. E. W. Greenfield
Kaiser Aluminum & Chemical Corporation
Department of Metallurgical Research
Spokane 69, Washington

JUNIOR DISTRIBUTION ENGINEER

Electric utility serving in the East desires a graduate electrical engineer with some experience in the distribution field, preferably with a public utility. Permanent position—salary dependent on experience and ability. Applicants please include complete resume of experience and qualifications.

P-8221, Electrical World
330 W. 42 St., New York 36, N. Y.

UTILITY EXECUTIVE ENGINEER

LOCATION: Fast growing electric utility company in a large, progressive city in Florida, the nation's number one state in rate of industrial growth, and number two state in population growth.

RESPONSIBILITIES: Management of all engineering operations of company. Supervision and training of engineering department.

EXPERIENCE: Diversified engineering background in electric utility company, including a minimum of three years supervising engineers. Individual must have leadership ability, with potentiality for further advancement. Ability will be regarded as of greater importance than just years of experience.

AGE: 35-45 desirable.

SALARY: Commensurate with the high level qualifications demanded by the position.

REPLY: Confidentiality assured. Write, giving summary of qualifications to

P-8303, Electrical World
330 W. 42 St., New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITIONS VACANT

Junior Electrical Engineers—Five graduates for power stations and substation electrical design. Location New York with established Service Organization for a large group of electrical utilities. Requirements: 1 to 3 years with leading electrical equipment manufacturer, G.E. or Westinghouse test course, or actual electric design, operation, construction experience on steam, diesel or hydro plants and substations. Limited foreign travel possibilities in future. Reply stating age, education, experience, personal particulars, and minimum salary expected. P-8449, Electrical World.

Electrical Engineer as Assistant Superintendent for Midwest Municipal Electric and Water Utility. Experience in design, planning and operation of 2400/4160 volt distribution systems. Knowledge and experience in steam generation plants desirable. Excellent opportunity for advancement. Age 32-45. P-8215, Electrical World.

Recent civil engineer graduate to work for large electric power utility on transmission line layout and design. Experience desired but not essential. Age up to 30. Some travel required. Give resume of education, experience and references. P-8562, Electrical World.

Chief of Relaying Studies graduate professional engineer to prepare design and specifications of relay protection for power systems with 2 million horse power generating capacity, to carry out analysis of relay operation and to supervise training of relay personnel. Should have at least 5 years' experience this class of work and be under 40 years of age. Location Brazil. P-8506, Electrical World.

Transformer Engineer — Require graduate Electrical Engineer with design background to work in design department of rapidly growing transformer manufacturing company. Reply stating age, education, experience, personal particulars. Present employment treated confidentially until agreed. P-8475, Electrical World.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo, N. Y.

POSITION WANTED

Distribution Engineer; supervisory experience. Graduate E.E., May, 1049, age 38. To locate central or western U. S., utility or manufacturing. PW-8333, Electrical World.

FOR RATES OR INFORMATION About Classified Advertising *Contact The McGraw-Hill Office Nearest you.*

ATLANTA, 3
1321 Rhodes-Haverty Bldg.
WAlnut 5778
W. LANIER

BOSTON, 16
350 Park Square
HUbbard 2-7160
P. McPHERSON

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
H. BOZARTH
W. HIGGENS

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
C. J. LOUGHLIN

DALLAS, 2
Adolphus Tower
Main & Akard Sts.
PRospect 5064
J. CASH

DETROIT, 26
856 Penobscot Bldg.
WOodward 2-1793
L. SEEGAR

LOS ANGELES, 17
1111 Wilshire Blvd.
MAdison 6-4323
C. DYSINGER

NEW YORK, 36
330 West 42 St.
LOngacre 4-3000
R. LAWLESS
W. SULLIVAN
D. COSTER

PHILADELPHIA, 3
17th & Sansom St.
RIttenhouse 6-0670
E. MINGLE
J. WILLIS

ST. LOUIS, 8
3615 Olive St.
JEfferson 5-4867
H. BOZARTH

SAN FRANCISCO, 4
68 Post St.
DOuglas 2-4600
R. ALCORN
T. CARMODY

COIL WINDING

Open Time available for all types of Universal, Layer Wound & Bobbin Coils. High voltage Transformers for Radar & TV designed & built. Assembly facilities available for electronic sub-assemblies.

IRONBOUND OPERATING CO
110 Polk St., Newark, N. J.
MArket 3-4090

PERIODICALS

A.I.E.E. transactions back-volume wanted to buy for cash. Ashley. 27 E. 21, N.Y.C. (10).

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4581) will be received at Denver, Colorado, until January 26, 1956, for furnishing twelve 230-kv, 115-kv, and 15-kv insulated, 1-phase, 60-cycle, outdoor, oil-immersed, wound-type instrument transformers; two 75-kva and 225 kva, 1- and 3-phase, self-cooled, outdoor, oil-immersed, 13,800- to 240x480- and 14,400/13,200- to 120/240-volt distribution transformers; and six 97-kv and 195-kv, station-type lightning arresters for Granite Falls Substation, Missouri River Basin Project, South Dakota. Delivery is desired within 210 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR Bureau of Reclamation. Sealed bids (Invitation No. DS-4566) will be received at Denver, Colorado, until January, 19, 1956, for furnishing twenty 230-kv, 115-kv, and 15-kv; 2,000-ampere and 1,200-ampere, 3-pole and single-pole, outdoor, manually-gang-operated and hook-operated, air switches for Granite Falls Substation, Missouri River Basin Project, South Dakota. Delivery is desired within 210 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation (No. DS-4582) will be received at Denver, Colorado, until January 19, 1956, for furnishing one 10,000/12,500-kva, 110- to 34.5-kv, 3-phase, class OA/FA, outdoor autotransformer, having a 2,700/3,375-kva (external load), 12.47-kv tertiary winding, and with tank-mounted arresters for Lingle Switchyard, Missouri River Basin Project, Wyoming. Delivery is desired within 150 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus
Branch Offices:

Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148

FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL Wire and Cable Co.

2664M N. Clybourn Ave., EAstgate 7-4777
Chicago 14, Ill. Code: UNIWIRE

MOTORS · GENERATORS TRANSFORMERS
NEW · REBUILT
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT CO.
PHONE STATION COLLECT GL 6781
BOX 51 ROCHESTER 1, NEW YORK

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES · EQUIPMENT - USED or RESALE

RATES

UNDISPLAYED

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

DISPLAYED

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for December 26th issue closing December 14th

TRANSFORMERS

FOR SALE

3—1000 Kva Mol. 11500-2400/4160Y
3— 500 Kva W-H 33000-2300/2400
3— 500 Kva G-E 22000-2300/4000Y
5— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/11950Y
3— 333 KVA G-E 7200/12470Y-2400/4160Y
3— 250 Kva G-E 2415/2300-600
8— 200 KVA G-E 13200-2400/2300
8— 200 KVA G-E 13200-230/460
1—1500 KVA W-H 34500-2400/4160Y 3-ph., with substation equip't

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
3	1000	Mol.	110,000—460
1	3750	West.	69000—14400, 3 ph.
4	2500	Mol.	66000—13800
4	750	G.E.	66000/114000—13200
4	500	West.	69000—6900
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900/11950
3	1250	A.C.	44000/115000—460
3	200	West.	44000—480
3	75	West.	44000—7200/12470Y
1	7500	A.C.	39838/69000Y—13,200, 3 ph.
3	5000	G.E.	38150/66000—6600
1	3750	Penna.	38030/65865Y—13800, 3 ph.
4	3333	G.E.	38100/66000Y—33000
4	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	35000/11000—2400/7200
1	3000	G.E.	33000—6900/2300, 3 ph.
2	3000	Stand.	33000—4160, 3 ph.
1	2500	A.C.	34500—13800, 3 ph.
1	2000	Kuhl.	33000—6900, 3 ph.
3	667	A.C.	33000—2400/4160Y
3	200	A.C.	34500—2400/7200/12470Y
3	75	Wag.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph.
3	2000	G.E.	26400/13200—2400
5	1250	G.E.	26400/13200—2400
3	600	G.E.	26400—2400
4	1500	A.C.	25400/44000Y—6900/11800
3	333	G.E.	23800/13200—2400
3	100	G.E.	22000—7200/12470Y
2	3000	G.E.	13800—600, 3 ph. Unit Sub.
3	1200	West.	13800—600, 3 ph. Unit Sub.
1	1000	West.	13200—2300, 3 ph. Unit Sub.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASEAREL
3	200	G.E.	13200—2300
3	125	A.C.	6900—2300
3	37½	G.E.	6900—230, 460
3	50	G.E.	4800, 2400—240, 480
3	333	G.E.	2400/4160Y—460
3	250	G.E.	2300/4000Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G.E.	2300—575, 3 ph.
6	50	West.	2400—115/220 Dry Type

ALSO:—FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYN. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, ETC.

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

FOR SALE

1—2000 KW .8 P.F. 2500 KVA 3 phase 60 cycle, 4160 volt G. E. Condensing Generator set.
1—15 K.W. G. E. 125 volt shunt wound direct connected exciter.
1—G. E. Generator Surface Type Air Cooler Used 10 years.
1—Wickes Bent Tube Steam Boiler 351 H. P. for working pressure 400 lbs psi complete with Detroit Stoker.

CITY OF FORT MORGAN
Box 1060 Fort Morgan, Colorado

MOTOR GENERATOR SETS

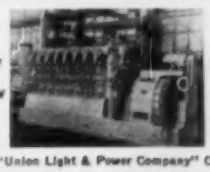
KW	MAKE	A.C.	D.C.
1000	G.E.	13200	600
500	Westg.	2300	250
400	Al.-Ch.	2300	120/240
400	G.E.	2300	270
300	G.E.	2300	250
200	G.E.	2300	250/275
200	Westg.	4160/2280	275
200	Ridgeway	2300	250
170	G.E.	440	125
150	Al.-Ch.	2300	275
150	Westg.	2300	125/150
150	G.E.	440	275
100	G.E.	2300	250
100	Westg.	440	125
100	G.E.	440	125
75	Al.-Ch.	440	250
75	G.E.	440	125

CHICAGO ELECTRIC CO.
1324 W. Cermak Rd. Chicago 8, Ill.

DIESEL ELECTRIC POWER

Stationary—Portable—Mobile

100 KW to 1500 KW



Engineered Diesel Power

"Union Light & Power Company" Cabs.

A. G. SCHOOHMAKER COMPANY, INC.
Box 810 Sausalito, Cal.
80 Church St. New York 7, N. Y.

CIRCUIT BREAKER SWITCHES

Mfg. by Hopax Electric Co., Chicago, Ill.
Model P.M.B-25 125 Volts A.C. 8 Amps.
Original Factory Cost $1.25 each.
Our Price 25 cents each.
5000 pieces available.

G. & M. MATERIALS CO.
Townsend 8-5838 12955 Hamilton Av., Detroit 3, Mich.

Save Money — Save Time

Contact us for prices, on large power equipment of all kinds. Prompt shipment from inventory. Send for our complete catalog.

BELYEA COMPANY INC.
51 Howell St. Jersey City, N. J.

PUBLIC RELATIONS AND ADVERTISING

NEWS n' NOTES

from Reddy and Speedy

ROCHESTER GAS and ELECTRIC

WHY BILLS VARY

It's "TOUGH" and "GO" with a DISHWASHER

MANY FINE TRADE-INS AT YOUR R, G & E,!

FACTS ABOUT GAS HEATING COSTS

YOU'RE LEADING AN ELECTRICAL LIFE

"WHAT D'YA KNOW" RETURNS TONIGHT!

How to Identify RG&E Employees

How To Cut Fuel Costs

Gifts To Show The Invalid!

FREE HOME TRIAL of DISHWASHER!

Taste Treats for All

BARBECUED SPARERIBS

Barbecue Sauce

PUMPKIN PIE

Fill out and return this coupon to:

DEPT. 34 Rochester Gas and Electric
89 East Avenue, Rochester 6, New York

NAME .....

ADDRESS ..... PHONE .....

'News Page' Ad Draws Reader Interest

Rochester Gas & Electric Co is running a full tabloid-size page advertisement in the Rochester Times-Union every Saturday. Designed to get across a sales, advertising and public relations story, the ad is laid out as if it were a regular newspaper page of news carrying several other items, with no apparent advertising.

Rochester G&E reports it is very satisfied with the reaction it is getting from the ad. James J. Brady, manager of advertising and sales promotion, says:

"For instance, in the issue of Nov. 19, we ran a little story captioned 'A Dust-free Home Through Electronics.' As of this morning (Nov. 23) we have received 20 telephone calls and four coupons requesting more information and sources of supply for these devices.

"This kind of reaction is typical each week of items relating to house heating, rewiring in existing homes, adequate wiring, and home appliances.

"All in all, we believe that we have hit on a relatively inexpensive medium for getting our industry's vast service story over to our customers. We are certain of careful and thorough readership by the coupon response to carefully buried and very small items offering recipe folders."

PR & A BRIEFS

• Pennsylvania Power & Light Co has launched its program of educational assistance for the third year. Aimed at providing financial assistance to deserving young people in its service area and financial assistance to certain independent colleges in the area, it gives the student $500 and the college $500.

• Wisconsin Public Service Corp is readying its second farm short course scholarship contest for the 1956-57 short course. This year there were 39 prizes awarded, including 13 winners receiving scholarships to the University of Wisconsin Farm Short Course valued at $240. Second and third place contestants received savings bonds. WPS says contest has been success from public relations point of view and it looks for even better results from the second contest.

• Survey of 19 member companies of Southeastern Electric Exchange shows following disposition of advertising expenditures: Sales 59.2%; area development 10.5%; institutional 23.1%; stockholder relations 1.7%; employee publications 2.9%; dealer publications .5%; customer publications 2.1%. Media distribution is as follows: Newspapers 36%; miscellaneous publications 11.9% radio 8.5%; television 5.1%; direct mail 5.6%; outdoor 2.6%; displays, shows, exhibits 4.2%; other 26.1% (latter includes salaries, agency and production costs, etc).

• "Otter Tail Power Company, From Its Origin Through 1954," is the title of a 96-p history of the company by Thomas C. Wright, chairman of Otter Tail and son of the founder of the utility, Vernon A. Wright.

• Electric Companies Advertising Program theme which will be basis for advertising copy in 1956 is: "You get the best value in electricity from the 400 independent electric light and power companies."

• Con Edison has issued "Atomic Power and Safety," third in a series of simple booklets on atomic energy aimed at the younger generation.

Left — Heavy, felted asbestos walls are applied over and under the varnished cambric tapes . . . then thoroughly impregnated . . . *Right* — then the impregnated asbestos is compressed to a dense, homogeneous wall that ensures long cable life.

look beneath the braid

. . . that's where quality begins

felted asbestos walls assure long cable life

N.E.C. Type AVA cables may look alike, but a look under the braid shows how time-proven *Rockbestos* A.V.C. Type AVA is built to ensure long life.

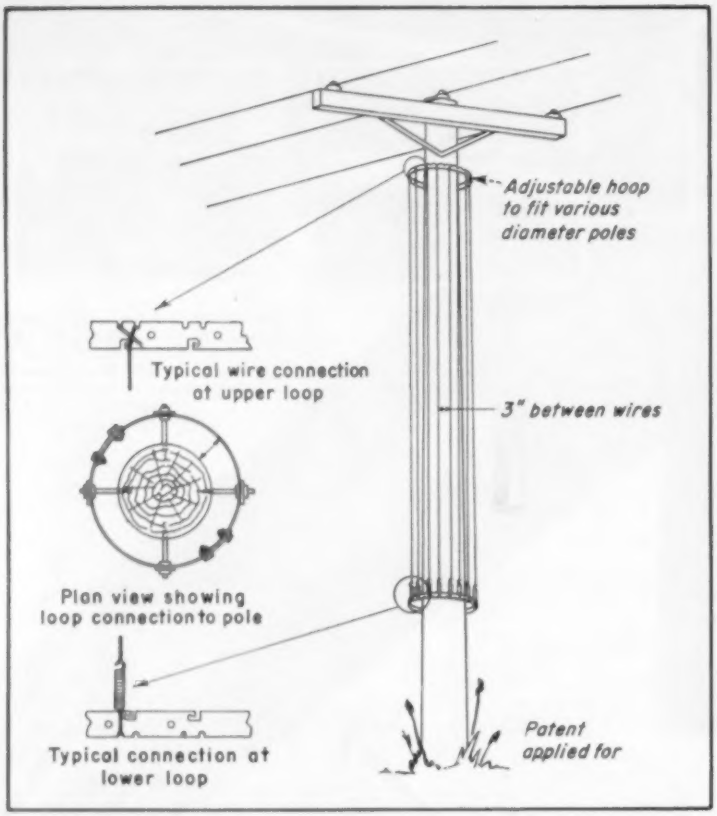
Each asbestos wall in *Rockbestos* A.V.C. construction is a dense, homogeneous, "seamless tube" . . . long, silky fibres of asbestos, thoroughly impregnated with selected compounds, make a nonporous, permanently heat-resistant wall. Heat dissipation is uniform. Dielectric strength is maintained under severe conditions. This seamless construction cushions the cable, protects the varnished cambric from rupture in the sharpest bends.

Write for the test and construction specifications of *Rockbestos* A.V.C. available in the new booklet: "Specification RSS-88".

STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for impediate shipment. Call or write nearest branch office.

ROCKBESTOS PRODUCTS CORP.
NEW HAVEN 4, CONNECTICUT

Cage Around Poles Keeps Out Woodpeckers


Adjustable hoop to fit various diameter poles
Typical wire connection at upper loop
3" between wires
Plan view showing loop connection to pole
Typical connection at lower loop
Patent applied for

CAGE DEVICE FRUSTRATES WOODPECKERS and protects utility poles, according to its inventor, A. E. Bergquist. Drawing gives the details of installation

To the Editor:

As an inventor of 45 years' experience, I have turned my energies toward solving the "woodpecker problem" of electric utilities. I think that my invention (patent applied for) will end forever the woodpecker menace.

My invention is a cage made of plastic cords strung vertically 3 in. apart between two hoops, one around the pole just below the wires and the other about 8 to 10 ft from the bottom. The cords are held under tension by springs attached to the bottom hoop. When the woodpecker attempts to land on a pole so protected, it bounces off.

The attached drawing clearly illustrates the invention and the method of attaching it to the pole.

If a lineman must work at the top of the pole, all he has to do is unhook the springs from the bottom hoop, gather the cords together, tie them together with a rope, and pull them away from the pole.

Installation time is an hour or less per pole. The cost will run from $6 to $15 per pole depending on its height.

One installation is under test on a pole of the East Central Electric Association, Braham, Minn.

Arthur E. Bergquist
Bergquist Manufacturing Co
Lindstrom, Minn.

Doctors Belong to More Societies

To the Editor:

In your editorial, "The Unity Is There," of Nov. 7, the following statement is made:

"While doctors or lawyers usually hold membership in but one national organization, electrical engineers are likely to belong to 2 or 3 of the national professional and industrial organizations."

This is a common error made by most engineers in referring to the "doctors," because of the tremendous impact the American Medical Association (AMA) has made upon the public. Actually, physicians belong to more organizations than do engineers, and some of them do not join AMA.

Attached is a list of 260 medical associations in the U.S.A. It is our understanding that some 55 state, etc, organizations are affiliated with AMA, but certainly most of them are not. I thought this list might be of interest to you.

L. F. Hickernell, Chairman
Planning & Coordination Committee
American Institute of Electrical Engineers
New York 18, N. Y.

PS of Oklahoma Can Well Be Proud

To the Editor:

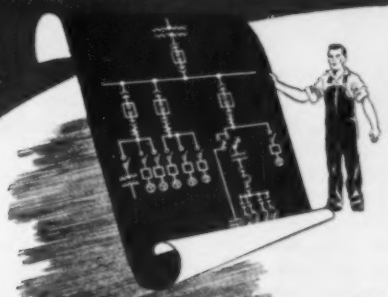
The story on personnel relations in your Sept. 19 issue (p 114) was certainly outstanding. We are quite proud to have been the subject of a story such as this.

Wright Canfield
Vice President

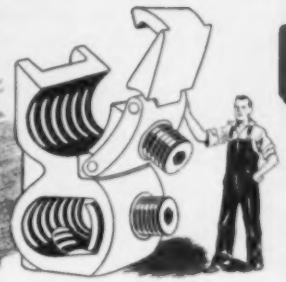
Public Service Co of Oklahoma
Tulsa, Okla.

ONE O.Z. FITTING DOES THE WORK OF 32

For Tee or Parallel Taps!



32 connector sizes needed on this job!



ONE connector size is plenty with this XTP!

One typical XTP connector replaces up to 32 different parallel or tee connectors because each XTP accommodates a wide range of wire sizes. All told, the XTP line of but 25 connectors will receive *over 400-wire size combinations!*

For either tee or parallel taps, just snap special hinged clamp over main and tighten the connector permanently in place—positive contact is assured. When you're ready to connect the tap, simply insert wire in tap end of connector. A wrench-turn or two, the job's done!

25 CONNECTOR SIZES do practically all tap jobs.

- Accommodate over 400 combinations of wire sizes
- Fit wire from #8 to 1,000,000 CM

HINGED CONSTRUCTION for quick installation.

SPRING STEEL LOCK WASHERS (tin plated) maintain pressure.

- Hold resiliency—assure permanent connection

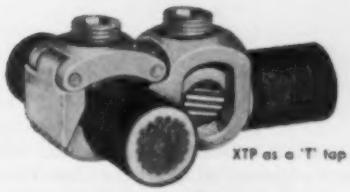
PRESSURE PLATES designed for maximum contact and grip.

- Serrated for firm grip
- Can not rotate during installation

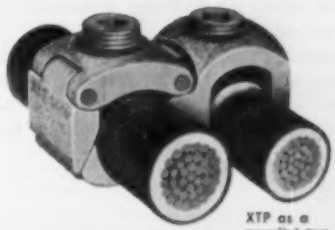
HIGH STRENGTH, HIGH CONDUCTIVITY.

- High conductivity copper alloy for body
- Extra strength copper alloy for pressure plates and hinged parts

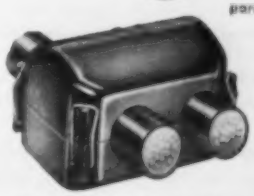
Get these combination fittings from your wholesaler now... and put an end to bulky assortments of tap connectors.



XTP as a 'T' tap



XTP as a parallel tap



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WASHINGTON COMMENT

Engineer Shortage Worries AEC Chiefs

High Schools must give more emphasis to mathematics and science training if the nation is to meet its requirements for nuclear engineers and scientists

The international atomic energy conference in Geneva last August did much to assure representatives of this country that the American program has gone forward faster than that of any other nation. Particularly did the free exchange of information which took place show the technological edge we have over other countries, including Russia.

But, reassuring though the comparison of present programs was, a serious threat to the American effort was disclosed: A shortage of American scientific and technical talent is in the making.

U.S. Must Push Training

Under any conditions the situation would demand attention. Under present world conditions—with the Russians putting forth every effort to raise their pool of skilled manpower in every field—the situation is serious and demands action.

This is being publicized by our top atomic energy officials. Atomic Energy Commission Chairman Lewis Strauss, Atomic Scientist and AEC Commissioner Dr Willard F. Libby, and Navy Reactor Chief Rear Adm H. G. Rickover have made pleas in recent speeches for new emphasis on science in education. The recent White House Conference on Education underscores the warnings of these experts on shortages of scientists and technicians being trained.

Strauss cites figures showing that the Russians are bounding ahead of U.S. schools and colleges in enrolling students in scientific and technical courses. He reported the U.S. requires 45,000 to 50,000 new trained engineers each year but that we are getting half that number. Last June's crop was 23,000. At the same time, Russia turned out 53,000 new engineers, and this number is expected to increase each year.

Between 1950 and 1960, Strauss says, Russia is expected to produce 1,200,000 trained engineers and scientists, as against 900,000 in this country.

Strauss says only about 16% of American high school graduates entering college last year enrolled in engineering courses. Of this total of 66,000, more than half will fail or switch to other courses.

Basic reason for this, all seem to agree, is poor high school preparation in science and mathematics. That's where the real trouble lies.

AEC cannot do much about this. It has asked for more funds next year to train more scientists and engineers in the atomic sciences. The agency has obtained White House approval of a multi-million-dollar program to provide reactors and other atomic equipment to colleges and universities and to help defray atomic students' expenses. But it sees this program as an emergency measure, designed chiefly to postpone an almost inevitable shortage of skilled manpower in this field.

High Schools Are Real Problem

Because the real problem lies in our secondary school system, rather than the colleges and universities, it is one which must be attacked in the high schools. As in other civic matters where public apathy results in a lack of progress, business leaders—including utilities executives—can play a vital part in getting something started.

TECHNICAL NOTES

Broken bricks in a station wall may indicate pressure from rust accumulating on the built-in steel frame.

Solar machines show best prospects where the sun is the best energy source and where they compete with man and animal power.

Electrical heating of hydro plants by heating water during system off-peak periods and storing it in insulated tanks for circulation when required for station heating leaves more of the generating capability available for heavy system load periods.

High real estate prices and esthetic requirements for downtown substations in large cities can justify construction as part of the lower floors of a company office building or garage.

Nuclear decisions are complicated by internal stresses in fuel elements, phase changes in metals, and boiling of corrosion films.

Carbon content of flyash has been found to be fairly well correlated with the degree of fuel fineness produced by the pulverizers; 2% carbon is reported where better than 90% goes through 200 mesh.

Good grounding of transmission lines is essential for lightning protection, but it does concentrate corrosion of the footings especially if galvanic current circulates over the overhead ground wire.

Power surges of an electric arc furnace can be shortened by a fast, sensitive regulator, but the voltage flicker still depends on supply system impedances.

Photograph courtesy of The Illuminating Company, Cleveland, Ohio

Meet a *Satisfied* user of Radiant Electric Heat

If this young man could talk, he'd tell you he never heard of drafts, cold floors or sleeping under mounds of blankets! Here is a fellow who knows all about electrically heated homes . . . from experience.

What do home owners like about electric heat? First of all, they appreciate the flexibility of a heating system that can "grow" with a house . . . one that lends itself equally well to building or remodeling. They like the constant source of fuel which is ever-present with electricity . . . and the fact that it is paid for only *after* it is used. They like its uniformity, its ease of control, its cleanliness!

What do utility companies like about electric heat? They like being ahead in a growing business. They like its tremendous load-building possibilities. Radiant electric heat builds good will for you through dependable, trouble-free performance.

The market for electric heat is beginning to boom and Blue Ridge is ready with RA-GRID® Heater Plates . . . time-tested for over 10 years. More RA-GRIDS are in service than any other make of heater plates—proof of their superiority and dependability. Today, Blue Ridge is the only manufacturer who makes the glass then fabricates it into the complete heater plate. For safety, faster heat-up, durability and beauty, look for units made with RA-GRID Heater Plates. Write for the names of radiant heater manufacturers who use RA-GRID Heater Plates.

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FINANCE AND REGULATION

Summary of Accounting and Rate-Making Treatment of Liberalized Depreciation for the Industry (Part I)

Number of commissions issuing orders..... 12

Number of orders issued..... 16

Analysis of accounting orders issued:
- Restricted or appropriated surplus..... 7
- Tax reserve 7
- Denial of application..... 2

State	Company	Date of Order	Accounting Disposition to Income	Accounting Disposition to Balance Sheet	Comments
Alabama	Alabama Power Co.	2/28/55	Sub % of 507	Restricted Surplus	Same accounting treatment as commission prescribed for accelerated amortization.
Florida	Gulf Power Co. ..... Tampa Electric Co.	9/1/55	Sub % of 507	Restricted Surplus	This order, which supersedes Accounting Bulletin No. 1 of 5/17/55, follows same accounting treatment as prescribed for accelerated amortization.
Georgia	Georgia Power Co.	8/16/55	Sub % of 507	Tax Reserve	This order is described as tentative pending further commission study of whether the claimd tax deferral is not in effect a permanent reduction of taxes. Accounting treatment is same as prescribed for accelerated amortization.
Illinois	Commonwealth Edison Co.	6/13/55	Sub % of 507	Tax Reserve	Order specifically prohibits any transfers being made from the reserve to surplus for payment of dividends. Also, order makes mention that it is for accounting purposes only.
Indiana	Petition of 6 Companies	12/23/54	Sub % of 507	Appropriated Surplus	Order mentions, specifically, the intent of Congress in enacting the liberalized tax provision and that the end result to be achieved is same as for accelerated amortization. The accounting treatment is identical as the commission's order for accelerated amortization.
Kentucky	Kentucky Power Co.	8/16/55	Sub % of 507	Restricted Surplus	Accounting order only. Not applicable to rate proceedings.
Louisiana	All utilities	6/13/55	Sub % of 507	Tax Reserve	Order is identical with one issued by the commission on 2/25/53 with respect to accelerated amortization.
Maine	Bangor Hydro-Electric Co.	1/12/55	Sub % of 4018 "Taxes Electric"	Tax Reserve	Order mentions similarity between new liberalized methods of tax depreciation and prior order issued to Central Maine Power Co. with respect to accelerated amortization.
Michigan	Consumers Power Co.	8/8/55	Sub % of 507	Tax Reserve	Original order with respect to accelerated amortization required a restricted surplus method of accounting for the deferral of taxes.
	Detroit Edison Co.	11/5/54	Sub % of 507	Tax Reserve	Order mentions similarity between new liberalized methods of tax depreciation and prior order with respect to accelerated amortization.
	Indiana-Michigan Electric Co	9/12/55	Sub % of 507	Appropriated Surplus	Commission disagreed with company's proposal but allowed it because prior order by Indiana commission gave company appropriated surplus method of accounting for liberalized depreciation.

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Part II will be published in next week's issue

the P&K story

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Electronics . . .

. . . applied to accounting will need changes to produce cost-saving plans, PCEA is told

Electronic data processing (EDP) applied to electric utility billing and accounting functions will require changes in present policies and practices to produce successful and cost-saving procedures. With a concentration of equipment and processing a prerequisite, EDP may reverse the trend toward decentralization of business activities.

These views were significant standouts during the joint fall conference of the Administrative Services Section, Pacific Coast Electrical Association, and the Accounting Section, Pacific Coast Gas Association, in Fresno, Calif., Nov. 16-17.

Application of EDP to billing and accounting functions can eliminate many steps now considered essential or desirable in present procedures, Everett S. Calhoun, EDP research manager, Stanford Research Institute, asserted. Elimination of these steps, particularly control checks between functions, will require new policies.

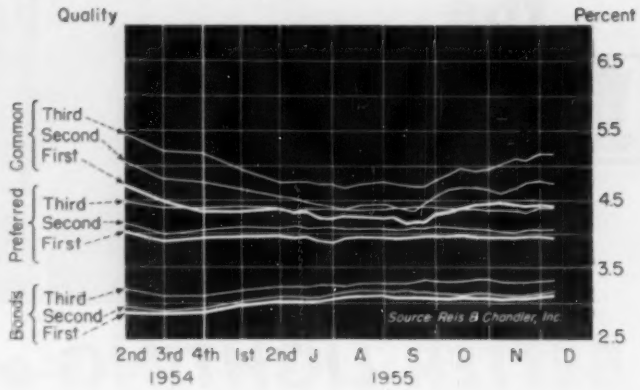
Three trends in new equipment design were seen by Calhoun: A move toward installing integrated systems and away from adding "hardware"—individual electronic machines. EDP equipment is being introduced into accounting processes to utilize input data produced as a byproduct of a normal and essential step.

Storage of information, rather than computation, is a second significant trend, said Calhoun. Of 12 EDP systems to be installed before 1957, most will emphasize extensive storage capacity. Three will have separate information processors.

Special purpose machines comprise the third trend. Completion of a system tailored for utility work is not closer than five years distant, Calhoun advised.

New buildings to house EDP are to be preferred over attempts to "compromise" new electronic machines into existing routines in old buildings, said Edward C. Longacre, Arizona Public Service Co. The new building should contain an engineering work room, instruction and training areas, machinery room, an electrical vault, and a storage room for maintenance and test equipment.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Dec. 1	3.11	3.14	3.29	3.95	4.06	4.38	4.41	4.72	5.15
Nov. 23	3.09	3.11	3.28	3.98	4.04	4.38	4.42	4.75	5.14

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Consumers Power	12	Oct.	$28,214,512	$26,426,647	$3.27(a)	$3.13(a)
Detroit Edison	12	Oct.	25,941,559	21,369,810	2.40	1.98
Kansas City Power & Light	12	Oct.	7,738,905	7,026,816	2.34(b)	2.31(b)
Middle South Utilities, consolidated	12	Oct.	16,601,205	16,207,610	2.18	2.13
Virginia Electric & Power	12	Oct.	19,041,809	15,903,261	2.54(c)	2.27(c)
Western Light & Telephone	12	Oct.	1,556,936	1,214,311	2.69(f)	2.30(f)

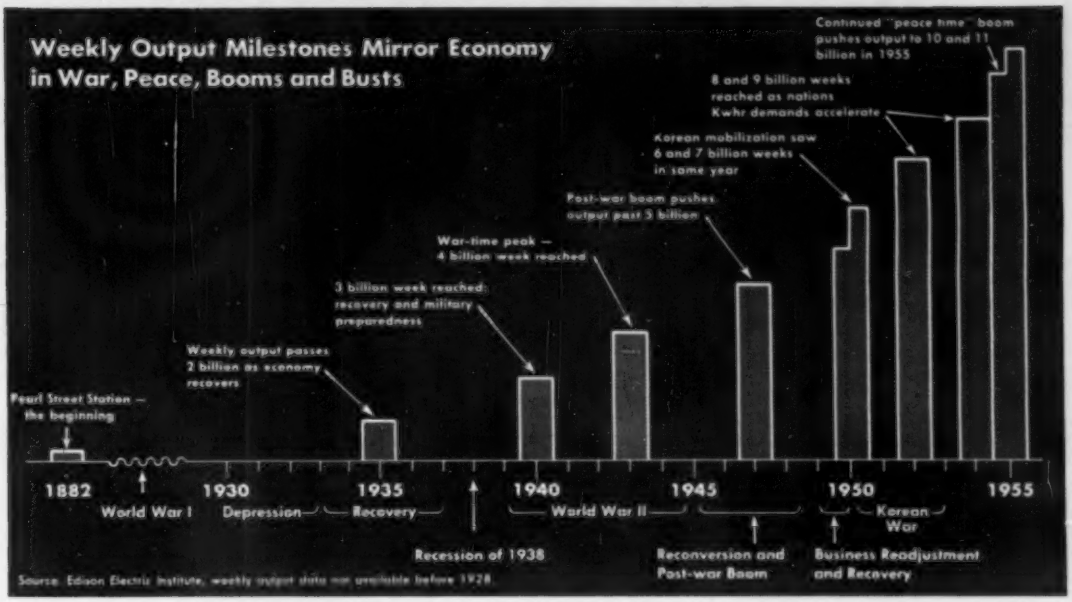
Notes—(a) Based on average number of shares outstanding; (b) Based on 2,695,000 shares in 1955 and 2,450,000 shares in 1954; (c) Based on 6,600,000 shares in 1955 and 5,999,980 shares in 1954, and (f) Based on 469,034 shares in 1955 and 393,686 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
DECEMBER 1-7			
BONDS			
Consolidated Edison—1st mtg due 3⅛% 1985	$70,000	101	3.32%
PREFERRED STOCK			
Virginia Electric & Power—125,000 sh 4.12% $100 par	$12,500	101.73	4.05%
COMMON STOCK			
Columbus & Southern Ohio Electric—250,000 sh	(See Electrical Week p 87)		
SCHEDULE FOR DECEMBER—JANUARY			
BONDS			BID DATE
Connecticut Light & Power—1st mtg 3¼% due 1985	$20,000		Dec. 8(b)
Delaware Power & Light—1st mtg due 1985	10,000		Dec. 13
Pennsylvania Electric—1st mtg due 1986	21,000(a)		Jan. 17
PREFERRED STOCK			
Delaware Power & Light—50,000 sh $100 par	$5,000		Dec. 13
New Orleans Public Service—60,000 sh $100 par	6,000		Jan. 11
Pennsylvania Electric	8,000		Jan. 17
COMMON STOCK			
Texas Utilities	15,000(a)		Jan. 31

Notes—(a) Estimated; (b) Putnam & Co group, underwriters.

STATISTICS


Weekly Output Milestones Mirror Economy in War, Peace, Booms and Busts
Continued "peace time" boom pushes output to 10 and 11 billion in 1955
8 and 9 billion weeks reached as nations Kwhr demands accelerate
Korean mobilization saw 6 and 7 billion weeks in same year
Post-war boom pushes output past 5 billion
War-time peak — 4 billion week reached
3 billion week reached: recovery and military preparedness
Weekly output passes 2 billion as economy recovers
Pearl Street Station — the beginning
1882
1930
1935
1940
1945
1950
1955
World War I
Depression
Recovery
World War II
Korean War
Recession of 1938
Reconversion and Post-war Boom
Business Readjustment and Recovery
Source: Edison Electric Institute, weekly output data not available before 1928

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	110.91	110.03	99.16	11.8
Peak—Class I Systems (million kw)	Aug.	91.6	89.3	79.7	14.9
Estimated Dec. '55 Peak	Sept.	96.82	96.54	96.21	0.6
Production—billion kwhr	Sept.	46.34	49.35	39.55	17.2
Hydro		8.17	9.53	7.80	4.7
Fuel		38.18	39.82	31.74	20.3
Sales—billion kwhr	Aug.	43.44	40.89	36.28	19.7
Residential		10.46	9.89	9.30	12.5
Commercial		7.39	6.92	6.56	12.7
Industrial		22.84	21.50	17.80	28.3
Other		2.74	2.59	2.62	4.6
Fuel Consumption	Sept.				
Coal—million tons		12.07	12.59	9.72	24.2
Oil—million barrels		5.18	5.37	4.90	5.7
Gas—billion cu ft		120.17	132.55	118.62	1.3
Net Income Class A & B Co's—$ million	Sept.	100.23	93.95	92.26	8.6
Residential Customers—millions	12 mos.	44.10	43.96	42.82	3.0
Revenue per kwhr	ended	2.66¢	2.66¢	2.70¢	−1.5
Avg kwhr per customer	Sept. 30	2,698	2,682	2,497	8.0
Avg. annual bill		$71.77	$71.34	$67.42	6.5

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Oct.	146	142	130	12.3
ENR Construction Cost	Oct.	141.2	141.0	134.6	4.9
BLS Cost-of-living	Oct.	114.9	114.9	114.5	0.3
NEMA Sales	Sept.				
Insulation materials		156	147	123	26.8
Electric appliances		131	111	115	13.9
Household refrigerators		85	86	73	16.4
Wholesale prices	Oct.				
Motors and generators		125.3	125.1	121.8	2.9
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		146.3	146.1	135.1	8.3
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3

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Advertising Council, Inc. 185
Air Preheater Corp., The 34
Allen-Bradley Co. 35, 36
Allis-Chalmers Mfg .Co. ..... 4th Cover
12, 32, 33, 45, 164, 165
American Chain & Cable, Wire Rope Sling Dept. 10
American Creosoting Co. 58
American Steel & Wire Div., United States Steel Corp. 14, 15
American Telephone & Telegraph Co. 181
Anaconda Wire & Cable Co. 39
Anderson Brass Works, Inc. 163
Ansonia Wire & Cable Co. 192

Babcock & Wilcox Co. 76, 77
Bakelite Co., Div. Union Carbide & Carbon Corp. 54
Bechtel Corp. 43
Bethlehem Steel Co. 50
Bishop Mfg. Corp. 176
Blue Ridge Glass Corp. 205
Brown Boveri Corp. 6
Brown Co. 160
Buffalo Forge Co. 40
Bussmann Mfg. Co. 18, 19

Central Transformer Corp. 38
Chance Co., A. B. 141
Chase Brass & Copper Co. 172
Chevrolet Div., General Motors 26, 27
Combustion Engineering, Inc. 28, 29
Continental Wire Corp. 174
Copper & Brass Research Ass'n. 135
Cornell-Dubilier Electric Corp. 142, 143

Delta-Star Electric Division, H. K. Porter Company, Inc. 133
Directory of Engineers 210
Dossert Mfg. Corp. 157
Dow Corning Corp. 152
Driver-Harris Co. 169
du Pont de Nemours & Co., (Inc.) Polychemicals Dept. 41

Electric Controller & Mfg. Co. 48
Electrical Engineers Equipment Co. 72, 73
Electromotive Div., General Motors 187
Electronic Contractors, Inc. 9
Engineers, Directory of 210
Everstick Anchor Co. 154
Exide Industrial Div., The Electric Storage Battery Co. ..... 3rd Cover

Fanner Mfg. Co., The 166
Ferranti Ltd. 67
Fisher-Pierce Co., Inc. 191
Flower Co., Arch T. 191

G & W Electric Specialty Co. 139
General Cable Corp. 44
General Electric Co.
Apparatus Dept. 24, 25, 82, 83, 117
118, 119, 120, 121, 122, 124, 125
128, 129, 130, 131, 193, 196, 197
Lamp Dept. 159
Globe Co., The 184
Gould-National Batteries, Inc. 156
Graybar Electric Co., Inc. 5
Greenlee Tool Co. 190
Grinnell Co., Inc. 7
Grip-Tite Mfg. Co. 192
Gulf Oil Corp. 145

Harper Co., The H. M. 42
Hazard Insulated Wire Works 4
Homelite Corp. 30
Hubbard & Co. 149
Husky Products, Inc. 170

I-T-E Circuit Breaker Co., R&IE Equipment Div. 11
I-T-E Circuit Breaker Co., Switchgear Div. 46, 47
Indiana Steel & Wire Co., Inc. 186
Ingersoll-Rand 63
International Harvester Co. 161

Johns-Manville 64
Joslyn Mfg. & Supply Co. 51

Kearney Corp., James R. 52
Keasbey & Mattison Co. 56
Kennecott Copper Corp. 80, 81
Kerite Co., The 84
Kim Hotstart Mfg. Co. 184
Kuhlman Electric Co. 68, 69

Locke Dept., General Electric Co. 70, 71

McCabe-Powers Auto Body Co. 162
McPhilben Lighting 168
Micro Balancing, Inc. 189
Midland Wire Corp., Div. Essex Wire Corp. 65
Minerallac Electric Co. 192
Minneapolis-Honeywell Regulator Co., Industrial Div. 136, 137
Moloney Electric Co. 60, 61
Monsanto Chemical Co. 49
Motorola Communications & Electronics, Inc. 59
Murray Mfg. Corp. 57

O. Z. Electrical Mfg. Co., Inc. 203
Okonite Co., The 4

Page Fence Ass'n. 188
Page Steel & Wire Div., American Chain & Cable 190
Pennsylvania Transformer Co. 20, 21
Pfaff & Kendall 207
Phelps Dodge Copper Products Corp. 22, 23
Pieper-Lillard, Inc. 188
Porcelain Products, Inc. 16
Preformed Line Products Co. 158

Radio Corp. of America 13
Republic Steel, Steel & Tubes Div. 66
Rockbestos Products Corp. 201
Royal Electric Mfg. Co. 178
Ryerson & Son, Inc., Joseph T. 193

Sangamo Electric Co. 53, 62
Searchlight Section 198, 199
Sierra Electronic Corp. 153
Simplex Wire & Cable Co. 147
Smith Co., S. Morgan 212
Sorgel Electric Co. 167
Southern States Equipment Corp. 31
Square D Co. 151
Standard Oil Co., (Indiana) 17
Standard Transformer Co. 74, 75
States Co., The 140
Stone & Webster Engineering Corp. 155
Superior Switchboard & Devices Co. 195
Sylvania Electric Products, Inc. 183

Texas Co., The ..... 2nd Cover
Thiel Tool & Engineering Co., Inc. 193
Thomas & Betts Co., The 179
Thomas & Sons Co., R. 55
Triangle Conduit & Cable Co., Inc. 37

Union Carbide & Carbon Corp., Bakelite Co., Div. 54
United States Rubber Co. 8

Victor Insulators Div., I-T-E Circuit Breaker Co. 171

Wagner Electric Corp. 78, 79
Western Precipitation Corp. 175
Westinghouse Electric Corp., Lamp Div. 177

■

PROFESSIONAL SERVICES 210

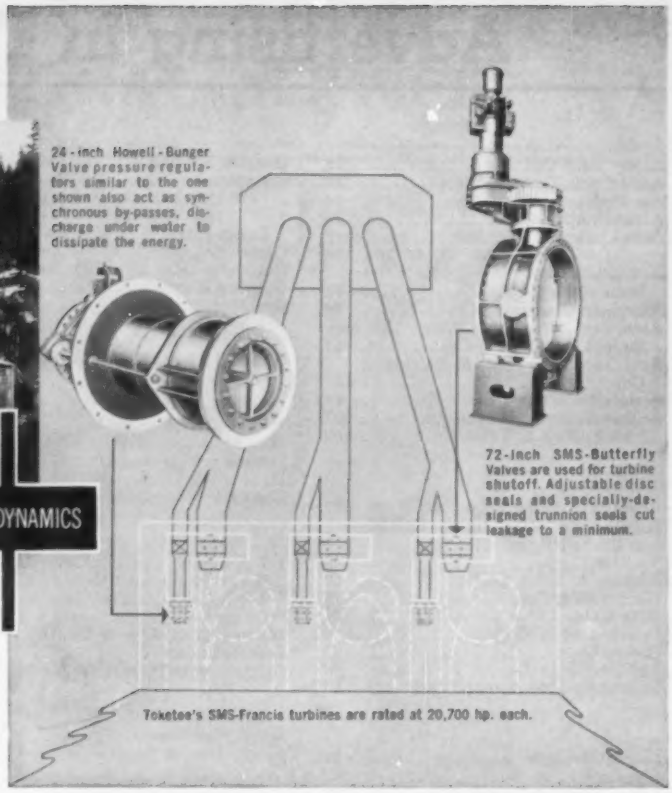
■

CLASSIFIED ADVERTISING
F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 198

EQUIPMENT
(Used or Surplus New)
For Sale 199

A single main penstock with a surge chamber feeds 3 SMS-Francis turbines operating under a 433-foot net head at Toketee.


24-inch Howell-Bunger Valve pressure regulators similar to the one shown also act as synchronous by-passes, discharge under water to dissipate the energy.
72-inch SMS-Butterfly Valves are used for turbine shutoff. Adjustable disc seals and specially-designed trunnion seals cut leakage to a minimum.
Toketee's SMS-Francis turbines are rated at 20,700 hp. each.

HYDRODYNAMICS

HOW COPCO'S NORTH UMPQUA PROJECT DELIVERS

Dual control arrangement of the Howell-Bunger Valves at Toketee makes it possible to pass a constant predetermined quantity of water regardless of turbine load. This helps control the down-river water level.

LOW-COST POWER

Eight years ago, the California Oregon Power Company was faced with a greatly accelerated load demand. To meet this challenge economically, a planned expansion program was started on the rugged, remote North Umpqua River. Today, eight new plants have added a total addition of 145,000 kw at an exceptionally low cost.

This North Umpqua project graphically demonstrates economy of construction and operation. One central station of conventional design – Toketee – remotely controls seven unattended single-unit, outdoor-type stations within a 12-mile radius.

Five SMS turbines, with a total rated output of approximately 124,000 hp, are used in this project. SMS accessories in five of these stations include 7 Howell-Bunger Valves – 3 of which are shown in the diagram interconnected with the Toketee turbines – 6 Butterfly Valves, 2 Elbow-type Pressure Regulators and 2 Motor-operated Trash Rakes. All are now in operation and exceeding guaranteed performance. To get full information on hydraulic turbines and accessories, contact us at York, Pennsylvania.

HYDRAULIC TURBINES
GATES & HOISTS
TRASH RAKES
PUMPS
ACCESSORIES
HYDRODYNAMICS
ROTOVALVES
FREE-DISCHARGE VALVES
BALL VALVES
CONTROLLABLE-PITCH SHIP PROPELLERS
BUTTERFLY VALVES

SMS

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED • TORONTO

Exide-equipped! The Jersey Central Power & Light Company's South Amboy plant relies on Exides. They provide the most dependable and durable power source for the unfailing operation of vital electrical equipment.

Switchgear operation assured for

JERSEY CENTRAL POWER & LIGHT by Exide-Manchex Batteries

The positive operation of switchgear is assured by the dependable performance of Exide Batteries. They control the switchgear equipment in the South Amboy Plant of the Jersey Central Power & Light Company pictured above.

EXIDE-MANCHEX FEATURES:

DEPENDABLE POWER which assures instant operation of circuit breakers

LARGE RESERVE OF POWER for all control circuits and emergency lighting

STATE OF CHARGE EASILY DETERMINED by simple hydrometer reading

NO ELECTROLYTE CHANGE during entire life of battery

LOW COST MAINTENANCE—water needed only twice a year

LARGE CAPACITY IN SMALL SPACE

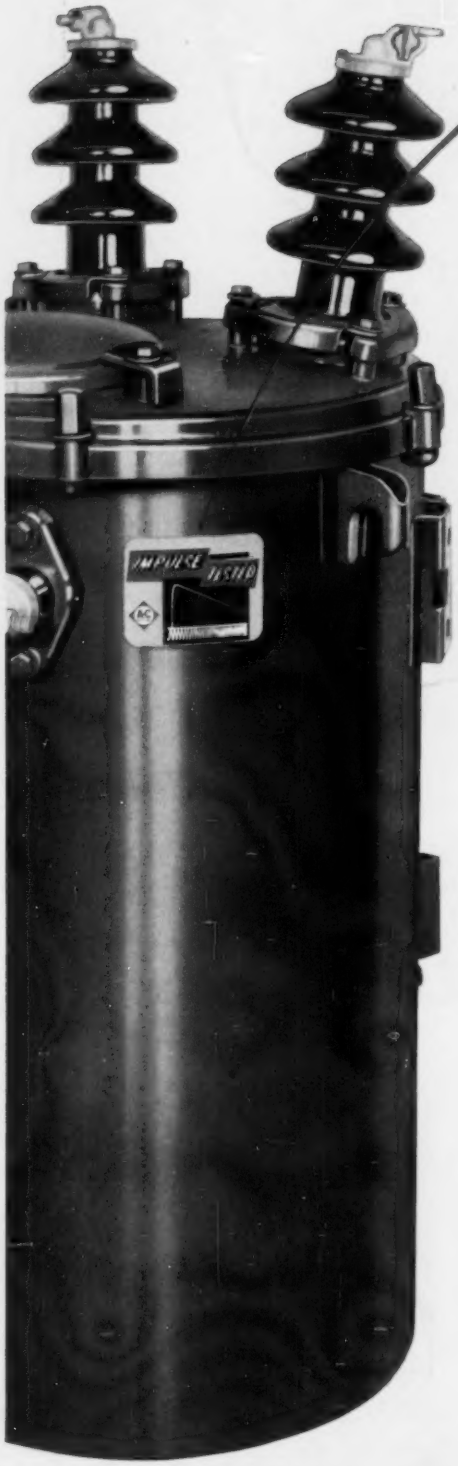
EXCEPTIONALLY LONG LIFE... low cost for owning and operating

These are the performance and operating features of the Exide-Manchex battery which make it your best power buy—AT ANY PRICE.

Get more details! For complete data on Exides used in switchgear control, emergency light and power, send for Bulletin 210. Call your nearby Exide branch office for complete battery engineering service.

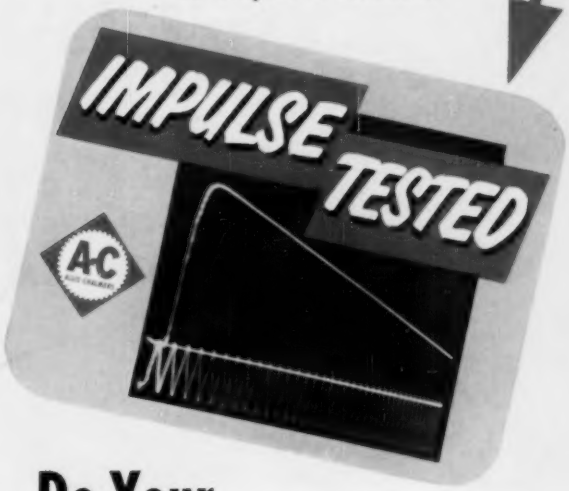
Exide-Manchex Batteries, like those relied upon at the South Amboy plant of the Jersey Central Power & Light Company, are also used by electric utilities all over the country. Exide-Manchex Batteries are your best switchgear power buy—AT ANY PRICE!

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.



This Seal

shows that every Allis-Chalmers distribution transformer is impulse tested.



Do Your Distribution Transformers Have This *Proof* of Quality?

REGARDLESS of size or voltage, every Allis-Chalmers distribution transformer brings you proof of insulation quality. The "impulse tested" seal on every unit shows that impulse tests were made during production with the most modern impulse testing equipment available to the industry.

Eight years ago Allis-Chalmers initiated impulse testing for pole-type units. Now, every unit through 500 kva, 69 kva and below, gets this positive check to assure that its insulation can withstand severe lightning and surge conditions. No lightning arrester is used. Allis-Chalmers tests the transformer, not the lightning arrester.

Get the facts on this and other A-C production line tests that result in distribution transformers of the highest quality. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4877

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